United States Department of the Interior

FISH AND WILDLIFE SERVICE
Nevada Fish and Wildlife Office
4701 North Torrey Pines Drive
Las Vegas, Nevada 89130
Ph: (702) 515-5230 ~ Fax: (702) 515-5231

November 1, 2010
File Nos. 84320-2010-F-0315 and
84320-2010-I-0316

Memorandum

To: Field Manager, Pahrump Field Office, Bureau of Land Management, Las Vegas, Nevada

From: State Supervisor, Nevada Fish and Wildlife Office, Reno, Nevada

Subject: Formal and Informal Consultation under Section 7 of the Endangered Species Act for the Amargosa Farm Road Solar Energy Project, Nye County, Nevada

This transmits the Fish and Wildlife Service's (Service) biological opinion in response to the Bureau of Land Management's (BLM) memorandum received May 20, 2010, requesting initiation of formal and informal consultation for the Amargosa Farm Road Solar Energy Project. BLM determined that the proposed issuance of a right-of-way for the subject project *may affect, is likely to adversely affect* the desert tortoise (*Gopherus agassizii*) (Mojave population), a species listed as threatened under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq*.).

BLM also requested our concurrence that the project *may affect, but is not likely to adversely affect* 12 listed species located in the action area:

- Devils Hole pupfish (*Cyprinodon diabolis*), endangered
- Ash Meadows Amargosa pupfish *(Cyprinodon nevadensis mionectes)*, endangered
- Warm Springs pupfish *(Cyprinodon nevadensis pectoralis)*, endangered
- Ash Meadows speckled dace *(Rhinichthys osculus nevadensis*), endangered
- Amargosa niterwort (*Nitrophila mohavensis*), endangered
- Ash Meadows naucorid (*Ambrysus amargosus*), threatened
- Ash Meadows milk-vetch (*Astragalus phoenix*), threatened
- Spring-loving centaury (*Centaurium namophilum*), threatened
- Ash Meadows gumplant (*Grindelia fraxinopratensis*), threatened

- Ash Meadows ivesia (*Ivesia eremica* [=*I. kingii* var. *eremica*]), threatened
- Ash Meadows blazing star *(Mentzelia leucophylla)*, threatened
- Ash Meadows sunray (*Enceliopsis nudicaulis* var. *corrugata*), threatened

The attached biological opinion is based on information in the project's biological assessment and addendums, and environmental impact statement; the Department of Interior Stipulation to Withdraw Protests of Groundwater Permit Applications; discussions between the Service and the BLM; and our files. A complete record of this consultation is on file in the Nevada Fish and Wildlife Office in Las Vegas.

The biological opinion is included as attachment 1 (Service File No. 84320-2010-F-0315) and the informal consultation as attachment 2 (Service File No. 84320-2010-I-0316). If you have questions regarding this correspondence or require additional information, please contact Brian Novosak in the Nevada Fish and Wildlife Office in Las Vegas at (702) 515-5230.

Robert D. Williams

Attachments

cc:
Senior Project Manager, Sacramento District, U.S. Army Corps of Engineers, Reno, Nevada
Superintendent, Death Valley National Park, National Park Service, Death Valley, California
Team Leader, Water Rights Branch, Water Resources Division, National Park Service, Fort Collins, Colorado
Wildlife Diversity Supervisor, Nevada Department of Wildlife, Las Vegas, Nevada

ATTACHMENT 2

Informal Consultation

The Bureau of Land Management (BLM) requested concurrence from the Fish and Wildlife Service (Service) that implementation of the Amargosa Farm Road Solar Energy Project *may affect, but is not likely to adversely affect* the following listed species listed below.

- Devils Hole pupfish *(Cyprinodon diabolis)*, endangered
- Ash Meadows Amargosa pupfish *(Cyprinodon nevadensis mionectes)*, endangered
- Warm Springs pupfish *(Cyprinodon nevadensis pectoralis)*, endangered
- Ash Meadows speckled dace (*Rhinichthys osculus nevadensis*), endangered
- Amargosa niterwort (*Nitrophila mohavensis*), endangered
- Ash Meadows naucorid (*Ambrysus amargosus*), threatened
- Spring-loving centaury (*Centaurium namophilum*), threatened
- Ash Meadows gumplant (*Grindelia fraxinopratensis*), threatened
- Ash Meadows ivesia (*Ivesia eremica* [=*I. kingii* var. *eremica*]), threatened
- Ash Meadows milk-vetch (*Astragalus phoenix*)
- Ash Meadows blazing-star *(Mentzelia leucophylla)*
- Ash Meadows sunray *(Enceliopsis nudicaulis* var. *corrugata)*

The Service reviewed BLM's request and information provided in the project's biological assessment (BLM 2010b), draft environmental impact statement (BLM 2010a), water rights settlement agreement (USDOI 2010), biological assessment addendum (BLM 2010c), and discussions between the Service and BLM and our files.

PROPOSED ACTION

A description of the proposed action is included in the biological opinion (Attachment 1) and the project's biological assessment (BLM 2010b, BLM 2010c) and is hereby incorporated by reference. The proposed groundwater use in Hydrographic Basin 230 is the only activity described in detail in this section because it is the only activity with the potential to have effects on the above federally listed species.

During the 39 months of construction, Solar Millennium LLC, (Solar Millennium) estimates that up to 600 acre-feet per year (afy) of groundwater would be required, or a total of 1,950 acre-feet. Once constructed, operation of the power plant would require an average of 400 afy for solar collector mirror washing, steam generation, dust control, cooling, potable water, and fire protection. Water requirements are expected to vary by season. Peak demands in summer months could be as much as 50 percent higher than the average. To accommodate these water needs, Solar Millennium would lease water from GENEERCO Incorporated (GENEERCO) (Permit 15893; Certificate 5717) in the amount of 603 afy during construction and 400 afy during operation (BLM 2010b). The full duty of GENEERCO's Permit 15893 is 603 afy; groundwater rights under this permit have not historically been fully utilized.

In March and April 2010, Amargosa Valley Solar I, LLC, a subsidiary of Solar Millennium, filed two applications with the Nevada Division of Water Resources (NDWR), Nevada State Engineer's Office for use of 400 afy in Hydrographic Basin 230 for the proposed solar project (water right applications). Application 79699 requests a change in the manner and place of use of 400 afy under the existing water rights held by GENEERCO. Application 79783 requests a new point of diversion (new well), located several hundred feet west-southwest of the well associated with Permit 15893 and a duty not to exceed 400 afy in combination with Application 79699. In effect, these two applications seek to change the point of diversion, manner and place of groundwater use from irrigation to industrial use.

Proposed Minimization Measures

To ensure pumping does not exceed 603 afy, flow meters would be installed and used on Permit 15893, Applications 79699 and 79783, and any point of diversion associated with additional acquired water rights (see below). Solar Millennium would report water use no less than quarterly to the Nevada State Engineer and BLM.

To offset the loss of irrigation return flow and possible increase in groundwater pumping which may result from the full utilization of Permit 15893 (in conjunction with Applications 79699 and 79783), Solar Millennium will acquire no less than 236 afy of preferably senior groundwater rights in the vicinity of Permit 15893 or closer to Devils Hole and Ash Meadows National Wildlife Refuge (NWR) (USDOI 2010). Preference will be given to rights that are currently used for agricultural purposes. These acquired rights would preferably be historically fully-utilized water rights. However, if fully-utilized rights totaling 236 afy are unavailable, sufficient rights will be acquired such that the cumulative total of the historical pumping average is no less than 236 afy (USDOI 2010). These acquired water rights will be held by Solar Millennium until such time that a memorandum of understanding is consented on among BLM, NPS, Nye County, and the Service (BLM 2010a).

To evaluate the potential for and provide early warning of impacts in advance of actual pumping to water-dependent ecosystems (Ash Meadows NWR and Devils Hole) within Hydrographic Basin 230 from groundwater pumping associated with the proposed project, BLM would contribute $30,000 to the operation of the U.S. Geological Survey (USGS) Amargosa Monitoring Network (BLM 2010d) and $410,000 towards the most recent update of the DVRFS and the SAMM (BLM 2009, as modified). Solar Millennium will also contribute $6,000 annually for the life of the solar project (for a total of $180,000) to the operation and maintenance of the Amargosa Monitoring Network (BLM 2010c).

ENVIRONMENTAL BASELINE

The action area is defined as all areas to be affected directly or indirectly by the Federal action, including interrelated and interdependent actions, and not merely the immediate area involved in the action (50 CFR § 402.02). Subsequent analyses of the environmental baseline, effects of the action, cumulative effects, and levels of incidental take are based upon the action area as determined by the Service.

The action area includes the 6,320-acre project located in the Amargosa Farms area, approximately 11 miles northwest of Ash Meadows NWR and 15 miles from Devils Hole, in south-central Nevada. The project would require groundwater from the Amargosa Desert Hydrographic Basin (Hydrographic Basin 230) of the Death Valley Hydrographic Region. The groundwater within Hydrographic Basin 230 supports aquatic and terrestrial habitat for the above 12 listed species that occur on Ash Meadows NWR and Devils Hole. Because of the project's proposed use of groundwater in Hydrographic Basin 230 and potential indirect affects to the above listed species from this activity, the action area also includes the Ash Meadows NWR and Devils Hole.

Water resources within the action area

The Ash Meadows NWR encompasses over 23,000 acres of spring-fed wetlands and alkaline desert uplands. The Refuge is a major discharge point for a vast underground carbonate aquifer system stretching 100 miles. The carbonate aquifer system is hydrologically connected to the Amargosa Desert Hydrographic Basin, covering an area of 2,593 square miles, which is part of the Death Valley Hydrographic Region.

Most of the springs are created by groundwater discharge from the carbonate aquifer system along the Ash Meadows fault system (Denny and Drewes 1965). Other seeps and springs discharge from saturated valley-fill sediments which overlie and are supplied by the carbonate aquifer system (Belcher 2004). The total annual discharge of Ash Meadows seeps and springs is an estimated 17,000 afy (Walker and Eakin 1963, Laczniak *et al.* 1999).

Devils Hole is a collapsed depression (opening) to the same carbonate aquifer system which supplies springs on Ash Meadows NWR within a 40-acre detached unit of Death Valley National Park located within Ash Meadows NWR. Devils Hole was established in 1952 and added to the then Death Valley National Monument (DVNM) by presidential proclamation, in which it was recognized for its uniqueness, scientific value, and for the endemic pupfish living within it (66 Stat. c.18, 17 Federal Register 691).

Since the early 1950s, extensive investigations have been conducted to evaluate the water-resources potential of the Death Valley Hydrographic Region, which include the impacts of groundwater pumping, information on groundwater recharge from wash infiltration, evaluation and characterization of regional groundwater flow and other water resources in the area. A series of extensive hydrological monitoring infrastructure has resulted in the accumulation of over 40 years of water level monitoring and water chemistry analysis in the region.

From 1969 to 1977, water pumping in the vicinity of Ash Meadows NWR reduced water levels in Devils Hole (Bedinger and Harrill 2006). In 1973, groundwater pumping in the vicinity of Ash Meadows NWR and Devils Hole was limited by an injunction issued by the U.S. District

Court in Nevada to restore the water level of the pool in Devils Hole to 3 feet below a reference point on the rock wall to protect the Devils Hole pupfish living in the pool. This decision eventually lead to the U.S. Supreme Court's decision in *Cappaert v. United States* (426 U.S. 128 1976), which held that the 1952 proclamation establishing Devils Hole as part of DVNM reserved that amount of water necessary to preserve the scientific interests associated with the pool. The consequence of this decision is that groundwater pumping is now limited, and a minimum water level of 0.82 m (32.4 in.) below the reference point was established with the goal of protecting the endangered Devils Hole pupfish. The water level rebounded from a historic low in 1972, with the maximum level in 1988 (USGS 2010). However, from 1988 to 2004 Devils Hole, water level measurements declined approximately 0.03 m (1.2 in) (NPS 2010, USGS 2010).

From 1983 to 1988, Ash Meadows NWR, spring discharge declined 0.3 cubic feet per second at Fairbank Spring (USGS 2010). However, discharge records for Ash Meadows NWR springs are inconsistent due to operational changes related to restoration activities. For instance, Five Springs well, the only monitoring well at the refuge completely in the carbonate aquifer (the source of the refuge springs), declined 0.06 m (2.4 in) from 1992 to 2004 (USGS 2010); however, the record is incomplete prior to 1992. From late 1980's to 2004, water levels also declined in two carbonate monitoring wells located between the Refuge and Army 1 WW. Army 1 WW is located 18 miles to the northeast of Devils Hole within Hydrographic Basin 230

Bedinger and Harrill (2006) used multiple regression analyses to examine these changes in water level in Devils Hole between 1963 and 2002 and concluded that the declines were due to pumping, not climatic factors (reductions in precipitation and groundwater recharge). They suggested that the water level declines in Devils Hole were primarily due to pumping that occurred between 1969 to 1977 at Ash Meadows and Amargosa Farms area. Secondarily, declines were a result of pumping that began in the 1950s and 1960s at a Department of Energy water supply well located at the south end of the Nevada Test Site (Army 1 WW, USGS site 363530116021401).

Since 2005, the water level in Devils Hole has increased approximately 0.11 m (4.32 in). It is unclear if this upward trend is due to reduced pumping in the basin or increased recharge from rain events. It is also unclear if this upward trend will be maintained or revert to a decline. As of May 2010, the water level in Devils Hole is 0.27 m (10.95 in.) above the minimum mandated water level (NPS 2010).

Solar Millennium proposes to lease water from GENEERCO (Permit 15893; Certificate 5717) in the amount of 603 afy during construction and 400 afy during operation (BLM 2010b). The full duty of GENEERCO's Permit 15893 is 603 afy; groundwater rights under this permit have not historically been fully utilized. Based on annual pumping estimates, historical groundwater pumping under Permit 15893 has averaged 398 afy (NDWR 2010a).

STATUS OF THE SPECIES IN THE ACTION AREA

1. Devils Hole pupfish

The Devils Hole pupfish was listed as an endangered species on March 11, 1967 under the Endangered Species Preservation Act of 1966 (32 Federal Register 4001) and later became grandfathered under the Endangered Species Act of 1973, as amended (Act). Devils Hole pupfish exist solely in a crack into a deep carbonate aquifer called Devils Hole within the boundaries of Ash Meadows NWR. Devils Hole is managed by NPS as part of DVNP. The southern third of Devils Hole contains a shallow shelf covered by water ranging from several centimeters (cm) to almost a meter in depth. Most algae production and thus the food base for the entire population are dependent upon the shelf. It is also where the pupfish does the majority, and perhaps all, of its reproduction.

In the 1960s and early 1970s, pumping of the groundwater aquifer for irrigation lowered the water level in Devils Hole, which resulted in a gradual de-watering of the submerged shelf. Concurrent with the de-watering of the shelf, litigation resulted in curtailed groundwater pumping and a mandated a shelf water depth sufficient to protect the species' habitat. From late 1970 through 1995, the population appeared to be relatively stable with an average population size of 324 individuals. Beginning in 1996 the population declined for unknown reasons reaching a low of 38 individuals in winter 2006. Since that time, the seasonally adjusted population has increased and has held steady with the 2010 spring and summer counts at 113. This trend is encouraging; however it remains below the recovery population goal of no less than 300 Devils Hole pupfish during the winter and 700 pupfish during late summer and early autumn (Service 2010a).

Current threats to the Devils Hole pupfish include changes in water level due to continued regional groundwater pumping (Deacon *et al.* 2007). In addition, because the pupfish occur in a single location and at relatively low numbers, they are subject to a variety of naturally occurring factors that could threaten their existence. These include stochastic genetic factors including drift and founder effect as a result of a genetic bottleneck. Furthermore, a single natural or anthropogenic event such as a local seismic event or accidental or malicious pollution could extirpate the entire species (Service 2010a).

2. Ash Meadows Amargosa pupfish

The Ash Meadows Amargosa pupfish, listed as endangered under the Act on September 2, 1983 (48 FR 40178), occurs in numerous springs and outflow channels within Ash Meadows NWR. Populations also exist in Crystal Reservoir, Lower Crystal Marsh, and Peterson Reservoir. The Ash Meadows Amargosa pupfish is a common fish relative to other endemic fish on Ash Meadows NWR (Scoppettone et al. 1995), being fairly widespread in suitable springs and their outflows and marsh areas. Population estimates have been problematic, and only springheads have been effectively measured, which contain an unknown but likely small proportion of the population. A substantial portion of the population seasonally occurs within marsh or shallow water habitats, and has never been effectively sampled.

Soltz and Naiman (1978) indicate that most Ash Meadows Amargosa pupfish occur downstream in outflow and marsh habitats; sites that have not been surveyed. Observations throughout Ash Meadows NWR suggest that the pupfish are frequently very abundant in outflows and flooded sites (Scoppettone et al. 1995), which cannot be effectively censused using conventional methods. For example, Crystal Spring harbored the highest population estimate (11,971; p=0.95) for the pupfish based on a native fish survey (NDOW 2007). However, trapping in Crystal Spring during the native fish survey only occurred from the spring orifice down to the start of the concrete channel behind refuge headquarters; therefore, the actual population size is likely larger than estimated. Based on the length of the surveyed portion of the Crystal system (approximately 0.25 miles) and the amount of other similar systems (approximately 16 miles), we estimate at least 750,000 adult pupfish may be seasonally present in spring channels on Ash Meadows NWR (NDOW 2007). This does not account for the fish that occur in marsh habitats or seasonal overflow of channels, which likely would increase the population estimate, nor does it account for juvenile fish that are not surveyed due to limitations in methodology, which also would add to the estimate. Additional information regarding relative abundance and distribution is being collected by the USGS.

Current threats to the Ash Meadows Amargosa include water diversion into earthen or concrete ditches, impoundments, competition from invasive aquatic species, reduction of habitat as a result of groundwater pumping, or elimination of riparian vegetation (Scoppettone *et al.* 1995, BLM and Service 2008).

3. <u>Warm Springs pupfish</u>

The Warm Springs pupfish was listed as endangered on October 13, 1970, under the Endangered Species Conservation Act of 1969 (35 FR 16047), and later grandfathered under the Act. The Warm Springs pupfish is restricted to five springs and their outflows in a 0.77 square mile (1.2 kilometer) area within Ash Meadows NWR known as the Warm Springs Complex. These springs discharge less than 1.7 gallons per second (Dudley and Larson 1976), and some have no source pool. Physiology of the fish allows for a wide range of suitable habitats, and fish may occur in nearly all habitats present within the Warm Springs Complex; however, some fish may be limited by upper thermal constraints, especially during spawning.

Warm Springs pupfish occur in areas of limited water volume; consequently their numbers are relatively few (Scoppettone *et al.* 1995). Population estimates have been problematic, and only springheads have been effectively measured, which contain an unknown but likely small proportion of the population. A substantial portion of the population occurs within marsh or shallow water habitats, and has never been effectively sampled. In April 2008, a mark-recapture survey in School Springs was conducted and determined the population to be 317 adult individuals; however, more than 600 juvenile and adult pupfish were salvaged immediately after this survey for the School Springs refugium restoration.

Current threats to the Warm Springs pupfish include reduction of habitat as a result of groundwater pumping, genetic bottleneck, competition from invasive aquatic species, and recent isolation of populations (Service 1990, Martin 2008).

4. Ash Meadows speckled dace

The Ash Meadows speckled dace was emergency listed as endangered on May 10, 1982 (47 FR 19995-19999). This emergency listing was in effect until January 5, 1983 at which time a second emergency listing and proposal of endangered status with critical habitat were published concurrently (48 FR 608-625). A determination of endangered status with designated critical habitat was published on September 2, 1983 (48 FR 40178-40186). The Ash Meadows speckled dace occurs in Bradford Springs and Jackrabbit Spring, and their outflows within the Ash Meadows NWR (48 FR 40178-40186). Little is known about the Ash Meadows speckled dace. Generally species of speckled dace prefer flowing streams where they feed on drifting insects (Moyle 1976); however, Amargosa Canyon speckled dace (*Rhinichthys osculus* ssp.) in California prefer pool habitat (Moyle 1995).

Population estimates of Ash Meadows speckled dace in Bradford Spring from mark-recapture surveys were 493 in 2005, 407 in 2007, and 175 in 2008 (NDOW 2007, 2008). At Jackrabbit Spring, population estimates for the spring pool and about 100 meters downstream were 117 in 2005 and 118 in 2007 (NDOW 2007). Several hundred young of year speckled dace were introduced into the combined outflow of the Point of Rocks springs in 2004 and 2005, and into Forest Spring in 2006. Current status of these populations is not known, but surveys have captured few fish indicating that the populations in these systems are minimal (USGS 2008). In April and August 2010, Ash Meadows speckled dace were repatriated into Fairbanks Spring outflow from the Jackrabbit Spring outflow ($N = 98$) and Bradford 1 Spring ($N = 20$). Monitoring of the repatriated fish indicates they are reproducing, but additional translocations may be necessary to ensure the long-term persistence of the species in the Fairbanks system.

Threats to Ash Meadows speckled dace include its limited distribution and the presence of introduced predatory and competing species (La Rivers 1962, Williams and Sada 1985, Service 1990). Collection records show that the speckled dace once shared many of the same springs and outflows that the Ash Meadows Amargosa pupfish inhabits (BLM and Service 2008), but now only occur in two springs, Bradford and Jackrabbit, in stable populations. Loss of faster-flowing, cool water due to habitat alteration, and introduced aquatic species, has prevented the reintroduction of the Ash Meadows speckled dace into most of its historical habitat.

5. Amargosa niterwort

The Amargosa niterwort, listed as endangered on May 20, 1985 (50 FR 20777-20794), occurs in the Ash Meadows area and Death Valley Junction/Tecopa area in Inyo County, California. The species is a slow growing, long lived perennial, and is best considered a wetland species associated with drainages and seeps that are adapted to extremely alkaline and saline soils devoid of other less tolerant species. At the time of listing, loss of habitat by groundwater pumping and development at Ash Meadows was one of the main listing factors for this species.

In 2005, Amargosa niterwort occupied approximately 25-30 acres between Crystal Reservoir and Crystal Marsh (Service 2005). The remaining populations of Amargosa niterwort in Nevada and California represent approximately two percent of the known distribution of ramets (Service 2007). The Lower Carson Slough population may be declining due to the species' inability to recover from impacts resulting from development activities (e.g. peat mining, water diversions, and groundwater pumping associated with large-scale farming) in the Refuge and Upper Carson Slough during the 1950s and 1960s. Rare Plant surveys conducted on Ash Meadows NWR from 2007 to 2009 estimate there are 58,292 ramets on 21 acres within the Refuge (BioWest 2010).

6. <u>Ash Meadows naucorid</u>

The Ash Meadows naucorid, was the first aquatic insect to be listed as threatened underthe Act on May 20, 1985 (50 FR 20777). They inhabit desert springs and are most abundant in patches of gravel to pebble sized substrates in areas of relatively fast flow (greater than 10-15 cm/sec) water (La Rivers 1953, Parker *et al.* 2000, Whiteman and Sites 2007). They also occur within smaller mineral substrates, submerged vegetation, and submerged roots of riparian vegetation (Parker *et al.* 2000). The Ash Meadows naucorid is currently restricted to short, upstream reaches of two spring systems on Ash Meadows NWR, the Refuge Springs Complex and the Middle Springs Complex, a total area of approximately 24 m^2.

Population surveys at multiple 15 cm by 15 cm quadrat sample areas in the Middle Springs Complex estimated 163 individuals in May 2010, 222 in June 2010, and 198 in August 2010 (Service 2010b, 2010d). Estimates in the Refuge Springs Complex estimated 376 individuals in May 2010, 176 in June 2010, and 318 in August 2010 (Service 2010c, Service 2010d).

Threats to Ash Meadows naucorid include reduction of habitat as a result of groundwater pumping, diversion of springs, trampling by livestock, crushing by off-highway vehicle (OHV) activity, and the introduction of invasive non-native species.

7. <u>Spring-loving centaury</u>

The spring-loving centaury, listed as threatened under the Act on May 20, 1985 (50 FR 20777), occurs within the Ash Meadows NWR, and on adjacent BLM and private lands. The spring-loving centaury grows in wet saltgrass meadows in the vicinity of springs, streams and seeps (Reveal *et al.* 1973). This species also occasionally occurs in alkaline clay soils in low uplands where water seeps are present (Reveal *et al.* 1973).

Suitable habitat for the species includes seeps, wet meadows, and spring channel banks throughout the refuge (Biowest 2010). Reveal *et al.* (1973) noted that development reduced the distribution of the species to remnant patches of natural vegetation in all the springs and seeps in the northern and eastern sections of the Ash Meadows area. From 2007 to 2009 rare plant surveys were conducted on Ash Meadows NWR. Surveys estimated 4.5 million individuals that occur on 527 acres (BioWest 2010).

The main threats to the spring-loving centaury include land clearing for road construction, reduction of habitat as a result of groundwater pumping, diversion of springs, trampling by livestock, crushing by OHV activity, and the introduction of invasive non-native species.

8. Ash Meadows gumplant

Ash Meadows gumplant was listed as threatened under the Act on May 20, 1985 (50 FR 20777-20794). This species occurs within the Ash Meadows NWR, and on adjacent BLM and private lands (Cochrane 1981, Knight and Clemmer 1987). The Ash Meadows gumplant exists in the transition zone between riparian areas, which are closely associated with springs, and the arid desert uplands. Its primary habitat is saltgrass meadow along streams and pools, but it occasionally occurs in alkali clay soils in drier areas (Cochrane 1981). The species is not found on rocky, sandy, and arid upland sites (Knight and Clemmer 1987).

The Ash Meadows gumplant is widely distributed across the Refuge with 23 occurrences at the minimum scale and one occurrence at the maximum scale (BioWest 2010). Survey results indicated 656,890 individuals on 136 acres (BioWest 2010).

The main threats to the Ash Meadows gumplant include land clearing for road construction, reduction of habitat as a result of groundwater pumping, diversion of springs, trampling by livestock, crushing by OHV activity, and the introduction of invasive non-native species.

9. Ash Meadows ivesia

Ash Meadows ivesia was listed as threatened under the Act on May 20, 1985 (50 FR 20777-20794). This plant grows in saline seep areas and adjacent uplands on light colored, alkaline limestone soils (Beatley 1977). Approximately 24 percent of its population occurs on soils that are saturated to the surface during winter months of normal years (White Horse Associates 2010).

As of 1987, seven populations were located in Ash Meadows (Knight and Clemmer 1987). Existing populations were smaller and less numerous than those known historically because of habitat eliminations during agricultural development. Building upon this information BioWest (2010) documented 19 minimum scale occurrences and two maximum scale occurrences on the Refuge. From 2007 to 2009, rare plant surveys were conducted on Ash Meadows NWR. Survey results indicated 510,744 individuals on 116 acres (BioWest 2010).

The main threats to the Ash Meadows ivesia include land clearing for road construction, reduction of habitat as a result of groundwater pumping, diversion of springs, trampling by livestock, crushing by OHV activity, and the introduction of invasive non-native species.

10. Ash Meadows milkvetch

The Ash Meadows milkvetch, as listed as threatened under the Act on May 20, 1985 (50 FR 20777) occurs within the Ash Meadows NWR, and in adjacent BLM and private lands. This plant was initially considered restricted to dry, upland areas outside of the influence of water by the Service (1990). Ash Meadows milk-vetch occurs in heavy alkaline soils which are poorly drained (Beatley 1977, Reveal 1978). Pavlik (2006) observed the species growing directly in channels with running and slow moving water during a high precipitation year, suggesting that this species may be more hydric.

In 1977, the species was known from nine occurrences at three sites (Beatley 1977). Reveal (1978) estimated the population to contain 1,000 individuals. In 1998, surveys were targeted on the six general areas identified by Knight and Clemmer (1987) and the total population was estimated to be about 1,800 plants on 847 acres (ac) (343 hectares [ha]) (BLM and Service 2000). From 2007 to 2009, rare plant surveys were conducted on Ash Meadows NWR indicating 12 minimum scale occurrences and two maximum scale occurrences estimating 15,606 individuals on 72.96 acres (BioWest 2010). During 2008, Ash Meadows milkvetch was discovered on a large tract on public land that has since been sold the Refuge. This tract has not been surveyed (BioWest 2010).

The main threats to the Ash Meadows milkvetch include land clearing for road construction, reduction of habitat as a result of groundwater pumping, diversion of springs, trampling by livestock, crushing by OHV activity, herbivory by rabbits (*Sylvilagus* spp.) and the introduction of invasive non-native species (Service 2009a).

11. Ash Meadows blazing-star

The Ash Meadows blazing-star was listed as threatened under the Act on May 20, 1985 (50 FR 20777-20794). The plant's distribution appears to be strictly limited to the Refuge (Otis Bay and Stevens Ecological Consulting 2006). Based on soil mapping conducted 2007-2009, about 77 percent of populations occur on a land type that is saturated to the surface during winter months of normal years (White Horse Associates 2010). From 2007 to 2009, rare plant surveys were conducted on Ash Meadows NWR. Survey results indicate that there are 12 occurrences at the minimum scale and two occurrences at the maximum scale and 1,513 individuals occur on 13.5 acres (BioWest 2010).

The main threats to the Ash Meadows blazing star include land clearing for road construction, reduction of habitat as a result of groundwater pumping, diversion of springs, trampling by livestock, crushing by OHV activity, and the introduction of invasive non-native species.

12. Ash Meadows sunray

The Ash Meadows sunray was listed as threatened under the Act on May 20, 1985 (50 FR 20777-20794). It was previously thought this species primarily occurred, but approximately 14 percent of its population occur on soils saturated to within 50 cm of surface during winter months (White Horse Associates 2010). This indicates that the plant's dependence on sub-surface moisture cannot be ruled out even in areas that are topographically high. From 2007 to 2009, rare plant surveys were conducted on Ash Meadows NWR. Surveys found 30 minimum occurrences and one maximum occurrence resulting in 79,508 individuals on 216 acres (BioWest 2010).

Although one of the more common species of plants endemic to Ash Meadows, its populations have been reduced by habitat elimination for agricultural production, land development, and road construction; trampling by resident wild and free roaming horses; and OHV activity. Because 14 percent of its population occurs on soils saturated to the surface by groundwater during winter months, groundwater pumping also may be a threat.

EFFECTS ANALYSIS

Groundwater Modeling

The BLM used the updated DVRFS model to simulate existing pumping in the Amargosa Desert Hydrographic Basin and evaluate the potential effects to water resources associated with the proposed project. Although, the DVRFS model is the only existing numerical groundwater model of the action area, the assessments of site-specific impacts performed using the DVRFS model have, at best, qualitative value. This tool is intended to model groundwater flow at a regional scale and cannot accurately predict hydraulic heads (spring flow) or water-level changes at specific locations (i.e., Devils Hole and springs at Ash Meadows NWR). These limitations include: 1) model grid size: the model averages water levels on 1,500 m x 1,500 m scale; 2) calibration to regional groundwater flow conditions; 3) dataset of outdated estimates of historic pumping (i.e., 2003 NDWR pumpage inventories); and 4) simplification of geology. For details on the DVRFS see *http://pubs.usgs.gov/sir/2004/5205/.*

Under current pumping rates, the model predicts that the water level at Devils Hole would decline by more than 13 feet after 200 years. When project pumping is included in the model, it predicts that water levels at Devils Hole would decline by 13.05 feet after 200 years, an additional 0.05 feet or 0.05 cm per project year. The analyses also showed a small, simulated decline in spring discharge at Ash Meadows NWR (BLM 2010a, 2010b). The USGS code ZONEBUDGET was used to evaluate the changes in water movement for the Amargosa Desert Hydrographic Basin. Under current pumping rates, the model predicts that discharge would be reduced from approximately 18,095 to 15,607 afy. When project pumping included in the model, the discharge rate in 2203 is predicted to be reduced to 15,600 afy, an additional 7 afy or 0.05 percent.

When considering these predictions, it is important to recognize that the model cannot accurately predict hydraulic heads or water-level changes at Devils Hole to 0.05 feet due to its original objective of modeling groundwater flow at a regional scale. However, it is currently the only existing numerical groundwater model of the action area and the incremental impact of the proposed action is quite small and masked within the normal variation due to natural influences such as tidal fluctuations (of several cm per day).

A detailed description of the results and explanation of the groundwater modeling effort are included in the project's biological assessment and is hereby incorporated by reference (BLM 2010b).

Hydrologic Impacts

Currently, there is uncertainty regarding the area's hydrogeology and the nature of the hydraulic connection between Amargosa Farms area, Ash Meadows NWR, and Devils Hole. Given the limitations of the DVRFS, it is not possible to model the extent to which the continuation of groundwater pumping in the area, including the proposed project pumping, may result in water level declines at Devils Hole and Ash Meadows NWR. Additionally, rather than water levels at Devils Hole declining 13 feet as predicted in the DVRFS, the Nevada State Engineer is expected to halt groundwater declines before they decline another 10.95 in., reaching the mandated minimum. We can, however, quantify and offset the possible increase in actual pumping and the loss of irrigation return flow from the proposed project that have the potential to adversely impact water resources.

Increase in actual groundwater pumping

Solar Millennium proposes to use the full duty of groundwater rights under the existing permit (603 afy during construction and 400 afy during operation); however, the full duty under this permit has not historically been fully utilized. During operation, when Solar Millennium is using 400 afy, GENEERCO may legally use the remaining 203 afy for irrigation resulting in an increase from the historical groundwater pumping of 398 to 603 afy of actual pumping. To offset the increase, Solar Millennium will acquire an additional 236 afy within Hydrographic Basin 230, of which 204 afy would offset the increase in groundwater pumping resulting from the full use of Permit 15893 (in conjunction with Applications 79699 and 79783). Additionally, to ensure pumping does not exceed 603 afy, flow meters will be installed and used throughout the project to monitor and document both the project's water use and GENEERCO's irrigation water use.

Loss of irrigation return flow

Changing the use of 400 afy from irrigation to industrial use is likely to have an impact on the groundwater supply. Agricultural water use allows some water to percolate back into the groundwater system (return flow). Water used for industrial utility-scale solar energy production likely will evaporate and no recharge to the local valley-fill aquifer is likely to occur. Additionally, no significant return flow is anticipated from solar mirror washing operations or other water uses as part of the project given the average low humidity and high temperatures in the Mojave Desert.

Groundwater pumping by GENEERCO under Permit 15893 is unmetered and, using calculations in NDWR (2010b) and Stonestrom *et al.* (2003), pumping has likely exceeded amounts accounted for by NDWR annual pumping inventories. Based on this information, the approximate uncompensated rate of lost irrigation return flow as a result of the project would be

8 percent, or 32 afy for each year of the project. Of the 236 afy acquired as part of the water rights stipulation, 32 afy would be used to offset the anticipated loss of irrigation return flow.

EFFECTS OF THE PROPOSED ACTION TO LISTED SPECIES

The 12 listed species are dependent on groundwater, including the Devils Hole pupfish which needs water above the shelf (Service 2010a) and the listed plants which need water within 50 cm of their root system (BioWest 2010). Therefore, the groundwater declines that have occurred due to groundwater pumping in the past have adversely affected these species and are likely to continue to affect these species. Small declines in spring discharge, changes in water temperature, and adjustments in soil or water chemistry resulting from the project's groundwater withdrawals in the basin may affect species inhabiting waters in Devils Hole, and spring pools and wetland systems at Ash Meadows NWR. The proposed use of 400 afy represents a small fraction (1.6 percent of the 25,000 afy) of groundwater allocated within the basin. The project proponent would offset the loss of irrigation return flow and possible increase in groundwater pumping by acquiring 236 afy of groundwater rights. Due to the mitigation included in this project, this project will not exacerbate the decline in groundwater levels and therefore the projects effects on groundwater levels are insignificant. Likewise, the effects of this project on the species are likely to be insignificant. Furthermore, we do not anticipate implementation of the proposed project to result in take of listed species.

In addition, to ensure the continued evaluation of potential impacts to listed species, BLM and the project proponent would monitor the proposed use of 603 afy of permitted water rights within Hydrographic Basin 230 and help support the Amargosa Monitoring Network, DVRFS and the SAMM. These tools would be used to provide information on water levels from project wells in the Amargosa Farms area to the Ash Meadows NWR and Devils Hole as a result of continued pumping for the proposed project in advance of many additional years of pumping. The operation and maintenance of the Amargosa Desert Monitoring Network would be cost-shared by the BLM, NPS, DOE, Nye County, USGS, and the Service (USGS 2010b). As mentioned above, the embedded model would be sufficiently refined and available to perform a site-specific analysis once developed.

CONCLUSION

The Service concludes, based on best available science, the acquisition and relinquishment of 236 afy is adequate to offset the possible increase in groundwater pumping and anticipated loss of irrigation return flow giving this project a no net increase in groundwater withdrawal. Furthermore, the Service regards the combination of measures proposed by BLM adequate to provide early warning of the propagation of adverse impacts to the Ash Meadows NWR and Devils Hole due to continued groundwater pumping from the proposed project in the Amargosa Farms area. Based on the project's information, our analysis, and the proposed minimization measures, we concur with your determination of *may affect, but is not likely to adversely affect* for the listed species identified above. This response constitutes informal consultation and does not authorize take of federally listed species.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to use their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

- *The Service recommends BLM, and other jurisdictional Federal agencies, continue to provide contributions to the operation and maintenance of a monitoring network and numerical groundwater flow model* (e.g., *the Southern Amargosa Desert Embedded Model and the Amargosa Desert Monitoring Network) that can be used to anticipate any propagation of drawdown from the area of the project wells in the Amargosa Farms area to the refuge and Devils Hole in advance of many additional years of pumping.*

- *The Service recommends BLM, and other jurisdictional Federal agencies, ensure actual annual groundwater withdrawal does not increase in Hydrographic Basin 230* (e.g., *full utilization of rights that have not been historically fully utilized, losses of irrigation return flow through change of use).*

- *The Service recommends BLM, and other jurisdictional Federal agencies, reduce other impacts that may be associated with the continuation of the current level of pumping in Hydrographic Basin 230* (e.g. *the purchase and relinquishment of additional water over project requirements).*

REINITIATION

As required by 50 CFR § 402.16, reinitiation of consultation is required where discretionary Federal agency involvement or control over an action has been retained (or is authorized by law) if: (1) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (2) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion; or (3) a new species is listed or critical habitat designated that may be affected by the action.

New information may be evaluated from ongoing collection of groundwater level data collected through the operation and maintenance of the Amargosa Desert Monitoring Network and DVRFS and SAMM. If, during the course of the proposed action, propagation of incremental impacts to the Ash Meadows NWR and Devils Hole due to continued pumping from the proposed project results in incidental take or loss of habitat occurs, such incidental take and habitat loss represents new information requiring reinitiation of consultation and review. The BLM, or other jurisdictional Federal agencies, must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification.

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ATTACHMENT 1:

BIOLOGICAL OPINION

A. CONSULTATION HISTORY

August 31, 2009: The Fish and Wildlife Service (Service) responded to a request from the Bureau of Land Management (BLM) for scoping comments (Service File No. 84320-2009-FA-0138). We recommended that the project's environmental impact statement (EIS) conduct a thorough analysis of direct, indirect, and cumulative effects to federally listed species, State-protected species, sensitive and at-risk species and migratory birds. We also recommended that BLM ensure impacts to sensitive water resources and water-dependent biological resources at Ash Meadows National Wildlife Refuge (NWR) and Devils Hole are minimized and Federal water rights are protected at these two nationally important areas.

November 23, 2009: We responded to a request from the consultant for Solar Millennium LLC, (Solar Millennium), EPG, for information on federally listed, threatened, and endangered species and designated critical habitats that may occur in or near the project area (Service File No. 84320-2010-SL-0048). We determined that 13 federally listed species may occur in and near the project area.

May 3, 2010: We provided comments to BLM on the draft EIS for the project (Service File No. 84320-2009-CPA-0138). We recommended BLM include a thorough analysis of the possible effects to desert tortoise (*Gopherus agassizii*) (Mojave population) from this project, identify measures to minimize mortality and injury to tortoises, and commit resources for conservation measures for tortoises as appropriate. We also asked BLM to address how the groundwater model construction and analysis described in the draft EIS provided uncertainties of the potential impacts to water-dependent federally listed species and their critical habitat in the Amargosa Farms area at Ash Meadows NWR and Devils Hole.

May 13, 2010: The Service reviewed the project and conducted a site visit with the U.S. Environmental Protection Agency, the U.S. Army Corps of Engineers (Corps), BLM, Solar Millennium and their consultants EPG and Tierra Data.

May 20, 2010: We received a biological assessment from BLM, dated May 20, 2010, requesting initiation of formal and informal consultation.

July 23, 2010: The Service, BLM, and the National Park Service (NPS) entered into a Stipulation to Withdraw Protests of Groundwater Permit Applications (Water Rights Stipulation) with Amargosa Valley Solar I, LLC (Solar Millennium) to protect Federal water rights and other water-dependent resources within the vicinity of the proposed points of diversion specified in the applications. Solar Millennium agreed to obtain 236 acre-feet per year (afy) of additional water rights prior to exercising any rights it obtains pursuant to the applications.

August 17, 2010: The Service determined that the information provided in the biological assessment and request to initiate consultation was insufficient to concur with BLM's determination. The Service requested additional clarification of several discussions, specifically: the acquisition and relinquishment of 236 afy of groundwater; the installation of meters at all project-related groundwater wells; and contributions to groundwater modeling.

August 27, 2010: The BLM requested an amendment to the May 20, 2010, biological assessment to include the acquisition and relinquishment of 236 afy, metering of project-related wells, commitment to monitoring the wells, addition of evaporation ponds, and clarification of the proposed memorandum of understanding (MOU).

September 10, 2010: Based on the Service's review of the May 20, 2010, and August 27, 2010, amendments to the biological assessment, it was determined that there was sufficient information to initiate consultation on the project. It was decided that the Service would provide a draft biological opinion to BLM no later than October 15, 2010, and the final biological opinion would be completed no later than November 1, 2010.

September 14, 2010: Based on new information regarding the Ash Meadows sunray (*Enceliopsis nudicaulis* var. *corrugata*) and its occurrence on soils saturated to the surface or within 50 centimeters of the surface during winter months, BLM requested to change the original determination of "no affect" to "may affect, but is not likely to adversely affect."

B. DESCRIPTION OF THE PROPOSED ACTION

1. Summary

The project proponent, Solar Millennium, submitted a right-of-way application for 6,320 acres to construct and operate two 232-megawatt (MW) dry-cooled solar power plants equipped with thermal energy storage capability, and associated ancillary facilities on BLM-administered land in Nye County, Nevada. The project area is located approximately 80 miles northwest of Las Vegas (BLM 2010b). Other jurisdictional Federal agencies may include the Corps (for a 404 permit under the Clean Water Act), the U.S. Department of Treasury (partial funding provided through the American Recovery and Reinvestment Act), and the Federal Communications Commission (for operation of a two-way radio communications system).

Facilities located within the project area would occupy a footprint of approximately 4,350 acres and consist of a conventional steam Rankine-cycle power block, parabolic trough solar field, heat transfer fluid and steam generation system, nitrate salt thermal energy storage system, power blocks, office and maintenance building, parking area, lay-down area, switchyard, and stormwater detention basin. Other facilities such as conventional water treatment, electrical switchgear, administration, warehouse, and maintenance facilities also would be located within the 4,350-acre footprint. A general site plan is shown on Figure 1-2 of the biological assessment (BLM 2010b).

The project would be built in two phases, with the construction of the first phase beginning in late 2010, immediately following issuance of the BLM right-of-way grant and other Federal, State, and local permits and approvals. The facility would operate for 30 years or more. A detailed description of the proposed action is in the project's biological assessment and is hereby incorporated by reference (BLM 2010b).

2. Construction

Solar Millennium would manage construction and contract several subcontractors to undertake the mechanical, civil and electrical construction tasks. Prior to construction, a detailed construction plan would be developed to define the construction supervisory and technical field organizations and staffing levels required for the project.

Project construction is expected to occur for 39 months. Solar Millennium would phase construction so that the first phase would be operational approximately one year before the second phase becomes operational. Project construction would require an average of 650 employees over the entire construction period, with manpower requirements peaking to approximately 1,300 workers in month 17 of construction. The construction workforce would consist of a range of laborers, craftsmen, supervisory, support, and management personnel.

Solar Field

The main element of a parabolic trough power plant is the solar field. The solar field consists of numerous parallel rows of solar collectors, arranged on a north-south axis. The parabolic trough solar thermal technology would be used to power steam turbine generators fed by solar steam generators. The solar collectors follow the path of the sun from east to west during the day to keep the sun's rays continuously focused on a receiver tube. The receiver tube contains a heat transfer fluid, which is a temperature-stable synthetic oil in a closed circuit that can be heated to temperatures of up to 400 degrees Celsius. Once heated, the oil is pumped to a centrally located power block, where it flows through a heat exchanger. The remainder of the process is similar to the steam cycle used in conventional power plants. The steam produced by the heat exchanger is used to drive a turbine connected to a generator, which produces electricity to be fed into a substation. The steam in the turbine condenses back into the water and the water is re-circulated through the solar field. With solar thermal technology, the heat is stored (referred to as thermal storage) and used during periods of cloud cover and up to 4.5 hours after sundown.

Perimeter Fence

The solar field and most of the other support facilities (access ways, assembly hall, administration building, laydown area, septic field, detention basins, and switchyard) would be enclosed within a combination of chain-link and wind fencing. Chain-link, metal-fabric security fencing, 8-feet tall, with 1-foot barbed wire (or razor wire) on top would be installed along the north and south sides of the facilities. Thirty-foot tall wind fencing comprised of A-frames and wire mesh would be installed along the east and west sides of each solar field. Controlled access gates would be located at the site entrance. The lower portion of all fencing would be designed to be desert tortoise-proof. Fence designs would be consistent with Service recommendations (Service 2009).

Roads

Solar Millennium is working with Nye County Public Works Department to realign Amargosa Farm Road either 250 feet or 1,320 feet south of the existing roadway. The realigned portion of Amargosa Farm Road would extend from the vicinity of Sandy Lane to Valley View Road; a distance of approximately 3.5 miles. If the road is placed 250 feet south, the facilities would be located south of Amargosa Farm Road; which would separate the solar fields from these facilities. If the road is placed 1,320 feet south, the facilities would be located north of Amargosa Farm Road; thereby keeping the project components north of Amargosa Farm Road.

Water Requirements and Source

During the anticipated 39 months of construction, Solar Millennium estimates that up to 600 afy of water would be required, or a total of 1,950 acre-feet. Once constructed, operation of the power plants would require an average of 400 afy for solar collector mirror washing, water for steam generators, dust control, cooling of auxiliary plan equipment, potable water, and fire protection. Water requirements are expected to vary by season. Peak demands in summer months could be as much as 50 percent higher than the average 400 afy. To accommodate these water needs, Solar Millennium would lease water from the current water rights holder, GENEERCO Incorporated (Permit 15893, Certificate 5717), for the construction phase and power plant operations during the anticipated 30-year life of the project (BLM 2010b).

Pipeline

A new pipeline would be constructed from the new well to the project site. Pipeline diameters would range from 8 to 14 inches. A main waterline would be constructed from the new point of diversion, located approximately 50 feet southwest of the northeast section corner of Section

23, Township 16 South, Range 48 East. The line would depart the point of diversion (across a private right-of-way) and head in a northeasterly direction approximately 100 feet to fall within the proposed project right-of-way.

3. Operation and Maintenance

The project would be staffed 24 hours a day, 7 days per week. A total estimated workforce of 100 full-time employees would be needed to staff the first phase of the project. When the second phase comes online, the full-time staff would increase to 180. The operations workforce includes plant operators and maintenance technicians working 12-hour shifts, and administrative personnel working 8-hour shifts per day.

During operation of the facilities, maintenance would include daily inspection of field components, condition assessment of critical equipment, and routine lubrication of equipment. Some specialized maintenance would be performed by the equipment provider or other specialist contractors. The plant switchyard would be controlled remotely, and routine inspections by personnel would occur on a monthly basis or as needed under emergency conditions. In addition, all of the switchyard structures would be inspected from the ground on an annual basis for corrosion, misalignment, and foundation condition. Ground inspection would include the inspection of hardware, insulator keys, and conductors. This inspection also would check conductors and fixtures for corrosion, breaks, broken insulators, and bad splices. Long-term maintenance would be performed against a defined service and replacement schedule. Road maintenance would be performed as needed. Paved roads would be swept, sealed, and overlaid as needed. Grading and drainage would be maintained for gravel and earthen roads.

Mirror washing is conducted at night and involves a water truck spraying treated water on the mirrors in a drive-by fashion. The mirrors would be washed weekly in the winter and twice weekly from mid-spring through mid-fall.

Waste

Project waste would be comprised of non-hazardous wastes including solids and liquids and lesser amounts of universal wastes. The non-hazardous solid waste would primarily consist of construction and office wastes, as well as liquid and solid wastes from the water treatment system. The non-hazardous solid waste would be trucked to the nearest landfill. Non-hazardous liquid waste would consist primarily of domestic sewage, and reusable water streams such as reverse osmosis system reject water, boiler blowdown, and auxiliary cooling tower blowdown. To manage the non-recyclable non-hazardous domestic sewage waste, evaporation ponds a septic tank and leach field would be installed.

4. Decommissioning and Restoration

The lifespan of the proposed project is expected to be at least 30 years. At the end of the project's lifespan, the facilities would either be repowered or decommissioned.

Decommissioning would adhere to the requirements of appropriate governing authorities and would be in accordance with all applicable Federal, State, and local permits, including any reclamation requirements BLM adopts for utility-scale solar projects. For this particular site, the decommissioning process would involve steps to dismantle and remove equipment, stabilize soil and drainages, and regrade and reshape features as necessary. Consistent with BLM requirements, a detailed decommissioning plan would be developed in a manner that protects public health and safety and is environmentally acceptable.

5. Proposed Desert Tortoise Avoidance and Minimization Measures

General Protective Measures

The BLM proposes to minimize the effects of the project on the desert tortoise and its habitat by ensuring several categories of measures are implemented: reducing speed limits; conducting worker awareness training; conducting clearance and monitoring of desert tortoise activity within the project area by an authorized desert tortoise biologist; constructing temporary and permanent desert tortoise exclusion fencing; implementing a litter-control program; implementing noxious weed control; minimizing habitat disturbance; and paying in-lieu fees for habitat loss. A complete list of proposed measures is included in the draft EIS and the biological assessment and is hereby incorporated by reference (BLM 2010a, 2010b).

Small petroleum spills from the operation of heavy equipment and filling of transformer and hydraulic equipment reservoirs would be cleaned up when they occur and the waste material properly disposed in accordance with Federal and State regulations.

Remuneration Fees

Prior to surface-disturbing activities associated with the project, BLM proposes to collect remuneration fees from the project proponent for compensation of desert tortoise habitat loss using guidance in BLM's August 17, 2010, instruction memorandum (NV- 2010-062). The BLM estimates that 4,350 acres of desert tortoise habitat would be disturbed. Total fees for disturbance of desert tortoise habitat within the material site and expansion area would be $3,366,900 ($774/acre x 4,350 acres) (Hastey *et al.* 1991). These funds would be used for management actions expected to provide a benefit to the desert tortoise over time. Actions may involve habitat acquisition, population or habitat enhancement, increasing knowledge of the species' biological requirements, reducing loss of individual animals, documenting the species current status and trend, and preserving distinct population attributes (Hastey *et al.* 1991).

Desert tortoise translocation

The boundaries of each construction area would be marked to prevent vehicles and personnel from straying onto adjacent offsite habitat. Prior to construction, desert tortoise clearance surveys and translocations would be conducted on each construction area in accordance with Service protocols (Service 2009a, 2010b, 2010c). If translocations of tortoises occur, the Service and the Nevada Department of Wildlife (NDOW) would approve the translocation sites. The Service considers all human-assisted moving of desert tortoises as translocations regardless of the distance.

The boundaries of each construction area would be marked and fencing would be erected around the perimeter to prevent vehicles or personnel from straying onto adjacent offsite habitat. Fencing would comply with the "Recommended Specifications for Desert Tortoise Exclusion Fencing" (Service 2009a).

Following construction of the desert tortoise exclusion perimeter fence, a desert tortoise clearance survey of the enclosed area would be conducted. Authorized desert tortoise biologists would conduct at least three complete sweeps of the project site using transects 30 feet wide. Surveyors would conduct transects for each sweep in different directions to allow for opposing angles of observation. During these surveys, an authorized biologist would inspect all burrows to determine occupancy (including eggs) and collapse all unoccupied burrows. For occupied burrows, all desert tortoises would be removed by an authorized biologist and placed in a sheltered location outside of the project area. Desert tortoise eggs would be relocated offsite in accordance with approved protocol (Service 2009a). The site would be considered cleared after two consecutive passes are completed without observing desert tortoises. Authorized biologists would excavate all potential desert tortoise burrows by hand to confirm occupancy status. Data would be collected on all desert tortoises handled and tortoises would be examined for clinical signs of disease. Health assessments would include a physical inspection (*i.e.*, notation of clinical signs of acute disease infection, body mass, and carapace measurements).

A record of all desert tortoises encountered and translocated during project surveys and monitoring would be maintained. The record would include the following information for each desert tortoise: the location (narrative, vegetation type, and maps) and dates of observations; burrow data; general conditions and health; measurements; any apparent injuries and state of healing; if moved, the location it was captured and the location it was released; whether desert tortoises voided their bladders; and diagnostic markings (i.e., identification numbers).

C. ANALYTICAL FRAMEWORK FOR THE SERVICE'S DETERMINATIONS

Section 7(a)(2) of the Endangered Species Act (Act) requires that Federal agencies ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of listed species. "Jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR § 402.02).

The jeopardy analysis in this biological opinion considers the effects of the proposed Federal action, and any cumulative effects, on the rangewide survival and recovery of the desert tortoise. It relies on four components: (1) the Status of the Species, which describes the range-wide condition of the desert tortoise, the factors responsible for that condition, and its survival and recovery needs; (2) the Environmental Baseline, which analyzes the condition of the desert tortoise in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the desert tortoise; (3) the Effects of the Action, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the desert tortoise; and (4) the Cumulative Effects, which evaluates the effects of future, non-Federal activities in the action area on the desert tortoise.

Section 7(a)(2) of the Act also requires that Federal agencies ensure that any action they authorize, fund, or carry out does not result in the destruction or adverse modification of designated critical habitat. Since the project does not occur in, nor will affect, designated critical habitat, critical habitat will not be discussed or analyzed in detail in this document.

D. STATUS OF THE SPECIES RANGEWIDE

The following summarizes the rangewide status of the desert tortoise, which includes information on its listing history, recovery plan, recovery and critical habitat, species account, reproduction, population distribution and monitoring, and threats.

1. Listing History

On August 20, 1980, the Service published a final rule listing the Beaver Dam Slope population of the desert tortoise in Utah as threatened (45 FR 55654). In the 1980 listing of the Beaver Dam Slope population, the Service concurrently designated 26 square miles of BLM-administered land in Utah as critical habitat. The reason for listing was population declines because of habitat deterioration and past over-collection. Major threats to the desert tortoise identified in the rule included habitat destruction through development, overgrazing, and geothermal development; collection for pets; malicious killing; road kills; and competition with grazing or feral animals.

On August 4, 1989, the Service published an emergency rule listing the Mojave population of the desert tortoise as endangered (54 FR 42270). On April 2, 1990, the Service determined the Mojave population of the desert tortoise to be threatened (55 FR 12178). Reasons for the determination included significant population declines, loss of habitat from construction projects such as roads, housing and energy developments, and conversion of native habitat to agriculture. Livestock grazing and off-highway vehicle (OHV) activity have degraded additional habitat. Also cited as threatening the desert tortoise's continuing existence were: illegal collection by humans for pets or consumption; upper respiratory tract disease (URTD); predation on juvenile desert tortoises by common ravens, coyotes, and kit foxes; fire; and collisions with vehicles on paved and unpaved roads.

On February 8, 1994, the Service designated approximately 6.45 million acres of critical habitat for the Mojave population of the desert tortoise in portions of California (4,750,000 acres), Nevada (1,220,000 acres), Arizona (339,000 acres), and Utah (129,000 acres) (59 FR 5820-5846, also see corrections in 59 FR 9032-9036), which became effective on

March 10, 1994. Desert tortoise critical habitat is composed of specific geographic areas that contain the primary constituent elements of critical habitat, consisting of the biological and physical attributes essential to the species' conservation within those areas, such as space, food, water, nutrition, cover, shelter, reproductive sites, and special habitats. The critical habitat is then further divided into 12 critical habitat units (CHUs) based on recommendations for DWMAs outlined in the *Draft Recovery Plan for the Desert Tortoise (Mojave Population)* (Service 1993).

Further information on desert tortoise critical habitat is included in the following documents:

- Desert Tortoise Recovery Plan Assessment Report (Tracy *et al.* 2004)—all CHUs
- Final Environmental Impact Report and Statement for the West Mojave Plan (BLM 2005)— Fremont-Kramer CHU, Superior-Cronese CHU, Ord-Rodman CHU, and Pinto Mountains CHU
- Mojave National Preserve General Management Plan (NPS 2002)—Ivanpah Valley CHU and Piute-Eldorado CHU
- Northern and Eastern Colorado Coordinated Management Plan (BLM 2002a)—Chemehuevi CHU, Pinto Mountains CHU, and Chuckwalla CHU
- Northern and Eastern Mojave Desert Management Plan (BLM 2002b)—Ivanpah Valley CHU, Piute-Eldorado CHU, and Chemehuevi CHU
- Clark County Multiple Species HCP (RECON 2000)—Beaver Dam Slope CHU, Mormon Mesa CHU, Gold Butte-Pakoon CHU, and Piute-Eldorado CHU
- Washington County HCP (Washington County Commission 1995)—Upper Virgin River CHU
- Biological Assessment for the Proposed Addition of Maneuver Training Land at Fort Irwin, CA (U.S. Army National Training Center 2003)—Superior-Cronese CHU
- Desert Tortoise (Mojave Population) Recovery Plan and Proposed Desert Wildlife Management Areas for Recovery of the Mojave Population of the Desert Tortoise (companion document to the Desert Tortoise Recovery Plan) (Service 1994)—all CHUs

2. Recovery Plan

On June 28, 1994, the Service approved the final Desert Tortoise (Mojave Population) Recovery Plan (1994 Recovery Plan) (Service 1994). The 1994 Recovery Plan divided the range of the desert tortoise into 6 recovery units and recommended establishment of 14 desert wildlife management areas (DWMAs) throughout the recovery units. Within each DWMA, the

1994 Recovery Plan recommended implementation of reserve-level protection of desert tortoise populations and habitat, while maintaining and protecting other sensitive species and ecosystem functions. The design of DWMAs should follow accepted concepts of reserve design. As part of the actions needed to accomplish recovery, the 1994 Recovery Plan recommended that land management within all DWMAs should restrict human activities that negatively impact desert tortoises (Service 1994). The DWMAs/ACECs have been designated by BLM through development or modification of their land-use plans in Arizona, Nevada, Utah, and parts of California.

The U.S. General Accounting Office (GAO) Report, *Endangered Species: Research Strategy and Long-Term Monitoring Needed for the Mojave Desert Tortoise Recovery Program* (GAO 2002), directed the Service to periodically reassess the 1994 Recovery Plan to determine whether scientific information developed since its publication could alter implementation actions or allay some of the uncertainties about its recommendations. In response to the GAO report, the Service initiated a review of the 1994 Recovery Plan in 2003. In March 2003, the Service impaneled the Desert Tortoise Recovery Plan Assessment Committee (Committee) to assess the 1994 Recovery Plan. The charge to the Committee was to review the entire 1994 Recovery Plan in relation to contemporary knowledge to determine which parts of the 1994 Recovery Plan needed updating. The recommendations of the Committee were presented to the Service and Desert Tortoise Management Oversight Group on March 24, 2004 (Tracy *et al.* 2004). The recommendations were used as a guide by a recovery team of scientists and stakeholders to modify the 1994 Recovery Plan.

On November 3, 2004, the Service announced the formation of the DTRO. The DTRO is revising the 1994 Recovery Plan and coordinating with regional recovery implementation work groups to develop 5-year recovery action plans under the umbrella plan. A draft revision of the recovery plan was released to the public on August 4, 2008 (Service 2008). The Service anticipates a final recovery plan in 2010.

The draft recovery plan identifies three recovery objectives:

1. Maintain self-sustaining populations of desert tortoises within each recovery unit into the future.

2. Maintain well-distributed populations of desert tortoises throughout each recovery unit.

3. Ensure that habitat within each recovery unit is protected and managed to support long-term viability of desert tortoise populations.

Recovery objectives and criteria generally will be measured within tortoise conservation areas or other areas identified by Recovery Implementation Teams, and they are not independent of each other but must be evaluated collectively. Recovery does not depend on absolute numbers of tortoises or comparisons to pre-listing estimates of tortoise populations, but rather the reversal of downward population trends and elimination or reduction of threats that initiated the listing.

3. Recovery Units

a. Northeastern Mojave Recovery Unit

The 1994 Recovery Plan delineates the Northeastern Mojave Recovery Unit to occur primarily in Nevada, but it also extends into California along the Ivanpah Valley and into extreme southwestern Utah and northwestern Arizona. Vegetation within this unit is characterized by creosote bush scrub, big galleta-scrub steppe, desert needlegrass scrub-steppe, and blackbrush scrub (in higher elevations). Topography is varied, with flats, valleys, alluvial fans, washes, and rocky slopes. Much of the northern portion of the Northeastern Mojave Recovery Unit is characterized as basin and range, with elevations from 2,500 to 12,000 feet. Desert tortoises typically eat summer and winter annuals, cacti, and perennial grasses. Since the northern portion of this recovery unit represents the northernmost distribution of the species, desert tortoises are typically found in low densities (about 10 to 20 adults per square mile).

The Northeastern Mojave Recovery Unit includes the Mormon Mesa, Coyote Spring, Beaver Dam Slope and Gold Butte-Pakoon DWMAs; and a portion of the Piute-Eldorado DWMAs. These areas generally overlap the Mormon Mesa, Piute-Eldorado, Beaver Dam Slope, and Gold Butte-Pakoon CHUs.

b. Eastern Mojave Recovery Unit

The 1994 Recovery Plan delineates the Eastern Mojave Recovery Unit to occur primarily in California, but also extends into Nevada in the Amargosa, Pahrump, and Piute valleys. The Ivanpah, Piute-Eldorado, and Fenner DWMAs are included in the Eastern Mojave Recovery Unit which generally overlap the Ivanpah and Piute-Eldorado CHUs in California. In the Eastern Mojave Recovery Unit, desert tortoises are often active in late summer and early autumn in addition to spring because this region receives both winter and summer rains and supports two distinct annual floras on which they can feed. Desert tortoises in the Eastern Mojave Recovery Unit occupy a variety of vegetation types and feed on summer and winter annuals, cacti, perennial grasses, and herbaceous perennials. They den singly in caliche caves, bajadas, and washes. This recovery unit is isolated from the Western Mojave Recovery Unit by the Baker Sink, a low-elevation, extremely hot and arid strip that extends from Death Valley to Bristol Dry Lake. The Baker Sink area is generally not considered suitable for desert tortoises. Desert tortoise densities in the Eastern Mojave Recovery Unit can vary dramatically, ranging from 5 to as much as 350 adults per square mile (Service 1994). The proposed project would be located in the Eastern Mojave Recovery Unit.

Using the U.S. Geological Survey habitat model (Nussear *et al.* 2009) and a 0.5 probability threshold based on the prevalence approach (Liu *et al.* 2005), the Service estimates that about one half of the Eastern Mojave Recovery Unit contains potential desert tortoise habitat (approximately 4,165,274 acres). Although this analysis likely omits some marginal desert tortoise habitat, it explains the occurrence of 95 percent of the 938 test points used in the model.

This analysis does not consider habitat loss, fragmentation, or degradation associated with human-caused impacts.

c. Northern Colorado Recovery Unit

The 1994 Recovery Plan delineates the Northern Colorado Recovery Unit completely in California. The 874,843-acre Chemehuevi DWMA is the sole conservation area for the desert tortoise in this recovery unit. Desert tortoises in this recovery unit are found in the valleys, on bajadas and desert pavements, and to a lesser extent in the broad, well-developed washes. They feed on both summer and winter annuals and den singly in burrows under shrubs, in intershrub spaces, and rarely in washes. The climate is somewhat warmer than in other recovery units, with only 2 to 12 freezing days per year.

d. Eastern Colorado Recovery Unit

The 1994 Recovery Plan delineates the Eastern Colorado Recovery Unit completely in California. The Chuckwalla DWMA and CHU, and a portion of the Joshua Tree DWMA and Pinto Basin CHU, occur in this recovery unit. This recovery unit occupies well-developed washes, desert pavements, piedmonts, and rocky slopes characterized by relatively species-rich succulent scrub, creosote bush scrub, and Blue Palo Verde-Ironwood-Smoke Tree communities. Winter burrows are generally shorter in length, and activity periods are longer than elsewhere due to mild winters and substantial summer precipitation. The desert tortoises feed on summer and winter annuals and some cacti; they den singly.

e. Western Mojave Recovery Unit

The 1994 Recovery Plan delineates the Western Mojave Recovery Unit completely in California. It is composed of the Western Mojave, Southern Mojave, and Central Mojave regions which are exceptionally heterogeneous and have broad, indistinct boundaries due to gradational transitions among sub-regions and with surrounding areas (Webb *et al.* 2009). The central Mojave is topographically and climatically transitional between the southwestern and eastern Mojave Desert. The south-central Mojave is a transitional region to the Colorado/Sonoran Desert, and the southern half of this region is similar climatically and floristically to the eastern Mojave. Many of the differences in vegetation among these regions can be explained by differences in climate (Rowlands 1995), which varies linearly across the range of the desert tortoise. The most pronounced difference between the Western Mojave and other recovery units is in timing of rainfall and the resulting vegetation. Most rainfall occurs in fall and winter and produces winter annuals, which are the primary food source of desert tortoises. Above ground activity occurs primarily in spring, associated with winter annual production. Thus, desert tortoises are adapted to a regime of winter rains and rare summer storms. Here, desert tortoises occur primarily in valleys, on alluvial fans, bajadas, and rolling hills in saltbush, creosote bush, and scrub steppe communities. Desert tortoises dig deep burrows (usually located under shrubs on bajadas) for winter hibernation and summer aestivation. These desert tortoises generally den singly.

Four DWMAs occur wholly or partially within the Western Mojave Recovery Unit: Fremont-Kramer, Ord-Rodman, Superior-Cronese, and Joshua Tree. These areas approximate the Fremont-Kramer, Ord-Rodman, Superior-Cronese, and Pinto Basin CHUs.

f. Upper Virgin River Recovery Unit

The 1994 Recovery Plan delineates the Upper Virgin River Recovery Unit to encompass all desert tortoise habitat in Washington County, Utah, except the Beaver Dam Slope, Utah population. Only the Upper Virgin River DWMA and CHU occur in this recovery unit. The desert tortoise population in the area of St. George, Utah is at the extreme northeastern edge of the species' range and experiences long, cold winters (about 100 freezing days) and mild summers, during which the desert tortoises are continually active. Here the desert tortoises live in a complex topography consisting of canyons, mesas, sand dunes, and sandstone outcrops where the vegetation is a transitional mixture of sagebrush scrub, creosote bush scrub, blackbush scrub, and a psammophytic community. Desert tortoises use sandstone and lava caves instead of burrows, travel to sand dunes for egg-laying, and use still other habitats for foraging. Two or more desert tortoises often use the same burrow.

4. Species Account

The desert tortoise is a large, herbivorous reptile that occurs in portions of California, Arizona, Nevada, and Utah. It also occurs in Sonora and Sinaloa, Mexico. The Mojave population of the desert tortoise includes those desert tortoises living north and west of the Colorado River in the Mojave Desert of California, Nevada, Arizona, southwestern Utah, and in the Sonoran Desert in California.

Desert tortoises reach 8 to 15 inches in carapace length and 4 to 6 inches in shell height. Hatchlings emerge from the eggs at about 2 inches in length. Adults have a domed carapace and relatively flat, unhinged plastron. Their shells are high-domed, and greenish-tan to dark brown in color with tan scute centers. Desert tortoises weigh 8 to 15 pounds when fully grown. The forelimbs have heavy, claw-like scales and are flattened for digging, while hind limbs are more stumpy and elephantine.

Optimal habitat for the desert tortoise has been characterized as creosote bush scrub in which precipitation ranges from 2 to 8 inches, where a diversity of perennial plants is relatively high, and production of ephemerals is high (Luckenbach 1982; Turner 1982; Turner and Brown 1982). Soils must be friable enough for digging burrows, but firm enough so that burrows do not collapse. Desert tortoises occur from below sea level to an elevation of 7,300 feet, but the most favorable habitat occurs at elevations of approximately 1,000 to 3,000 feet (Luckenbach 1982). Neonate desert tortoises use abandoned rodent burrows for daily and winter shelter; these burrows are often shallowly excavated and run parallel to the surface of the ground.

Desert tortoises are most commonly found within the desert scrub vegetation type, primarily in creosote bush scrub. In addition, they occur in succulent scrub, cheesebush scrub, blackbrush scrub, hopsage scrub, shadscale scrub, microphyll woodland, Mojave saltbush-allscale scrub and scrub-steppe vegetation types of the desert and semidesert grassland complex (Service 1994). Within these vegetation types, desert tortoises potentially can survive and reproduce where their basic habitat requirements are met. These requirements include a sufficient amount and quality of forage species; shelter sites for protection from predators and environmental extremes; suitable substrates for burrowing, nesting, and overwintering; various plants for shelter; and adequate area for movement, dispersal, and gene flow. Throughout most of the Mojave Desert region, desert tortoises occur most commonly on gently sloping terrain with soils ranging from sandy-gravel and with scattered shrubs, and where there is abundant inter-shrub space for growth of herbaceous plants. Throughout their range, however, desert tortoises can be found in steeper, rockier areas (Gardner and Brodie 2000).

The size of desert tortoise home ranges varies with respect to location and year. Desert tortoise activities are concentrated in overlapping core areas, known as home ranges. In the western Mojave Desert, Harless *et al.* (2007) estimated mean home ranges for desert tortoises to be 111 acres for males and 40 acres for females. Over its lifetime, each desert tortoise may require more than 1.5 square miles of habitat and make forays of more than 7 miles at a time (Berry 1986a). In drought years, the ability of desert tortoises to drink while surface water is available following rains may be crucial for desert tortoise survival. During droughts, desert tortoises forage over larger areas, increasing the likelihood of encounters with sources of injury or mortality including humans and other predators.

Desert tortoises spend most of the year in subterranean burrows or caliche caves (Nagy and Medica 1986). Desert tortoises in the west Mojave are primarily active in May and June, with a secondary activity period from September through October. In Nevada and Arizona, desert tortoises are considered to be most active from approximately March 1 through October 31. Their activity patterns are primarily controlled by ambient temperature and precipitation (Nagy and Medica 1986; Zimmerman *et al.* 1994). In the east Mojave and Colorado Deserts, annual precipitation occurs in both summer and winter, providing food and water to desert tortoises throughout much of the summer and fall. Most precipitation occurs in winter in the West Mojave Desert, resulting in an abundance of annual spring vegetation, which dries up by late May or June. Neonate desert tortoises emerge from their winter burrows as early as late January to take advantage of freshly germinating annual plants through the spring. Under certain conditions desert tortoises may be aboveground any month of the year, particularly during periods of mild or rainy weather in summer and winter.

During active periods, they usually spend nights and the hotter part of the day in their burrow; they may also rest under shrubs or in shallow burrows (pallets). Desert tortoises may use an average of 7 to 12 burrows at any given time (Bulova 1994; TRW Environmental Safety Systems Inc. 1997). Walde *et al.* (2003) observed that desert tortoises retreated into burrows when air temperature reached 91.0° Fahrenheit (F) ± 3.55° F and ground temperatures reached 94.6° F ± 6.05° F; 95 percent of observations of desert tortoises aboveground occurred at air temperatures less than 91° F. The body temperature at which desert tortoises become incapacitated ranges from 101.5° F to 113.2° F (Naegle 1976; Zimmerman *et al.* 1994).

Although desert tortoises eat nonnative plants, they generally prefer native forbs when available (Jennings 1993; Avery 1998). Consumption of nonnative plants may cause desert tortoises to have a nitrogen and water deficit (Henen 1997). Droughts frequently occur in the desert, resulting in extended periods of low water availability. Periods of extended drought place desert tortoises at even greater water and nitrogen deficit than during moderate or high rainfall years (Peterson 1996; Henen 1997). During a drought, more nitrogen than normal is required to excrete nitrogenous wastes, thus more rapidly depleting nitrogen stored in body tissues. Plants also play important roles in stabilizing soil and providing cover for protection of desert tortoises from predators and heat.

The U.S. Geological Survey modeled desert tortoise habitat across the range of the desert tortoise (Nussear *et al.* 2009). This model, which is based on 3,753 desert tortoise locations, uses 16 environmental variables, such as precipitation, geology, vegetation, and slope. In addition, Nussear *et al.* used 938 additional occurrence locations to test the model's accuracy. Using this model and a 0.5 probability threshold based on the prevalence approach (Liu *et al.* 2005), the Service estimates that there are approximately 20,542,646 acres of potential desert tortoise habitat rangewide. This analysis likely omits some marginal desert tortoise habitat, and it does not consider habitat loss, fragmentation, or degradation associated with human-caused impacts; however, it provides a reference point relative to the amount of desert tortoise habitat.

Further information on the range, biology, habitat, and ecology of the desert tortoise is available in: Bury (1982); Bury and Germano (1994); Ernst *et al.* (1994); Jennings (1997); Service (2008); Tracy *et al.* 2004; Van Devender (2002); and collected papers in Chelonian Conservation and Biology (2002, Vol. 4, No. 2), Herpetological Monographs (1994, No. 8), and the Desert Tortoise Council Proceedings.

5. Reproduction

Desert tortoises possess a combination of life history and reproductive characteristics that affect the ability of populations to survive external threats. Desert tortoises grow slowly, require 15 to 20 years to reach sexual maturity, and have low reproductive rates during a long period of reproductive potential (Turner *et al.* 1984; Bury 1987; Tracy *et al.* 2004).

Choice of mate is mediated by aggressive male-male interactions and possibly by female choice (Niblick *et al.* 1994). Desert tortoises in the West Mojave Desert may exhibit pre-breeding dispersal movements, typical of other vertebrates, ranging from 1 to 10 miles in a single season (Sazaki *et al.* 1995). The advantage of pre-breeding dispersal may be to find a more favorable environment in which to reproduce. However, risks include increased mortality from predation, exposure, starvation, or anthropogenic factors (e.g., motor vehicle mortality).

The average clutch size is 4.5 eggs (range 1 to 8; on rare occasions, clutches can contain up to 15 eggs), with 0-3 clutches deposited per year (Turner *et al.* 1986). Clutch size and number probably depend on female size, water, and annual productivity of forage plants in the current and previous year (Turner *et a*l. 1984, 1986; Henen 1997). The eggs typically hatch from late

August through early October. The ability to alter reproductive output in response to resource availability may allow individuals more options to ensure higher lifetime reproductive success. The interaction of longevity, late maturation, and relatively low annual reproductive output causes desert tortoise populations to recover slowly from natural or anthropogenic decreases in density. To ensure stability or increased populations, these factors also require relatively high juvenile survivorship (75 to 98 percent per year), particularly when adult mortality is elevated (Congdon *et al.* 1993). Bjurlin and Bissonette (2004) determined that 74 percent of desert tortoise nests survived and, over 2 years, 84 and 91 percent of the neonates survived the initial period of post-hatching dispersal. They predicted that 40 percent of eggs produce hatchlings that survive to hibernation at their study site. Desert tortoises generally lay eggs from mid-May to early July, but occasionally as late as October (Ernst *et al.* 1994). Eggs are laid in sandy or friable soil, often at the entrance to burrows. Hatching occurs 90 to 120 days later, mostly in late summer and fall (mid-August to October). Eggs and young are untended by the parents. Desert tortoise sex determination is environmentally controlled during incubation (Spotila *et al.* 1994). Hatchlings develop into females when the incubation (*i.e.*, soil) temperature is greater than 88.7° F and males when the temperature is below that (Spotila *et al.* 1994). Mortality is higher when incubation temperatures are greater than 95.5° F or less than 78.8° F. The sensitivity of embryonic desert tortoises to incubation temperature may make populations vulnerable to unusual changes in soil temperature (e.g., from changes in vegetation cover).

At Yucca Mountain in Nye County, Nevada (Northeastern Mojave Recovery Unit), Mueller *et al.* (1998) estimated that the mean age of first reproduction was 19 to 20 years; clutch size (1 to 10 eggs) and annual fecundity (0 to 16 eggs) were related to female size but annual clutch frequency (0 to 2) was not. Further, Mueller suggested that body condition during July to October may determine the number of eggs a desert tortoise can produce the following spring. McLuckie and Fridell (2002) determined that the Beaver Dam Slope desert tortoise population, within the Northeastern Mojave Recovery Unit, had a lower clutch frequency (1.33 ± 0.14) per reproductive female and fewer reproductive females (14 out of 21) when compared with other Mojave desert tortoise populations. In the 1990s, Beaver Dam Slope experienced dramatic population declines due primarily to disease, and habitat degradation and alteration (Service 1994). The number of eggs that a female desert tortoise can produce in a season is dependent on a variety of factors including environment, habitat, availability of forage and drinking water, and physiological condition (Henen 1997; McLuckie and Fridell 2002).

6. Population Distribution and Monitoring

Patterns of desert tortoise distribution are available from preliminary spatial analyses in Tracy *et al.* (2004). Their analyses revealed areas with higher probabilities of encountering both live and dead desert tortoises. In the western Mojave Desert, areas with concentrations of dead desert tortoises without corresponding concentrations of live desert tortoises were generally the same areas where declines have been observed in the past, namely the northern portion of the Fremont-Kramer CHU and the northwestern part of the Superior-Cronese CHU. Limited data revealed large areas where dead desert tortoises, but no live desert tortoises, were observed in the Piute-Eldorado Valley and northern Coyote Spring Valley, Nevada, and the western and southern portions of the Ivanpah Valley CHU in California. Most other recently sampled areas (mostly within critical habitat) reveal continued desert tortoise presence, although local population declines are known within some of these areas, such as the Beaver Dam Slope, Arizona.

Rangewide desert tortoise population monitoring began in 2001 and is conducted annually. The status and trends of desert tortoise populations are difficult to determine based only upon assessment of desert tortoise density due largely to their overall low abundance, subterranean sheltering behavior, and cryptic nature of the species. Thus, monitoring and recovery should include a comprehensive assessment of the status and trends of threats and habitats as well as population distribution and abundance. Studies during early research on desert tortoises focused on basic biology and demography and were largely centered in areas with high densities of desert tortoises. These high-density areas were used to establish permanent (long-term) study plots that have been studied at various intervals from 1979 through the present, while some low-density plots were discontinued (Berry and Burge 1984; K. Berry, U.S. Geological Survey, pers. comm. 2003, as reported in Tracy *et al.* 2004). However, historic estimates of desert tortoise density or abundance do not exist at the range-wide or regional level for use as a baseline. While a substantial body of data has been collected from long-term study plots and other survey efforts over the years, plot placement is generally regarded as a factor limiting demographic and trend conclusions only to those specific areas. Tracy *et al.* (2004) concluded that estimating accurate long-term trends of desert tortoise populations, habitat, and/or threats across the range was not feasible based on the combined suite of existing data and analyses. Instead, these data provide general insight into the rangewide status of the species and show appreciable declines at the local level in many areas (Luke *et al.* 1991; Berry 2003; Tracy *et al.* 2004).

In an attempt to refine the long-term monitoring program for the desert tortoise, annual rangewide population monitoring using line distance transects began in 2001 (1999 in the Upper Virgin River Recovery Unit; McLuckie *et al.* 2006) and is the first comprehensive effort undertaken to date to estimate densities across the range of the species (Service 2006). Rangewide sampling was initiated during a severe drought that intensified in 2002 and 2003, particularly in the western Mojave Desert in California. At the time the 1994 Recovery Plan was written, there was less consideration of the potentially important role of drought in the desert ecosystem, particularly regarding desert tortoises. In the meantime, studies have documented vulnerability of juvenile (Wilson *et al.* 2001) and adult desert tortoises (Peterson 1994, Peterson 1996, Henen 1997, Longshore *et al.* 2003) to drought.

The monitoring program is designed to detect long-term population trends, so density estimates from any brief time period (e.g., 2001 to 2005) would be expected to detect only catastrophic declines or remarkable population increases. Therefore, following the first 5 years of the long-term monitoring project, the goal was not to document trends within this time period, but to gather information on baseline densities and annual and regional (between recovery unit) variability (Service 2006). Density estimates of adult desert tortoises varied among recovery units and years. Only if this variability is associated with consistent changes between years will monitoring less than 25 years describe important trends. For instance, considerable decreases in density were reported in 2003 in the Eastern Colorado and Western Mojave recovery units, with no correspondingly large rebound in subsequent estimates (Service 2006). Until the underlying variability that may affect our interpretation of these first years of data can be identified, inferences as to the meaning of these data should not be made. Over the first 5 years of monitoring, desert tortoises were least abundant in the Northeast Mojave Recovery Unit (0.68 to 8.30 desert tortoises per kilometer^2 [0.26 to 3.20 desert tortoises per mile^2] (Service 2009b).

There are many natural causes of mortality, but their extents are difficult to evaluate and vary from location to location. Native predators known to prey on desert tortoise eggs, hatchlings, juveniles, and adults include: coyote, kit fox, badger (*Taxidea taxus*), skunks (*Spilogale putorius*), common ravens, golden eagles (*Aquila chrysaetos*), and Gila monsters (*Heloderma suspectum*). Additional natural sources of mortality to eggs, juvenile, and adults may include desiccation, starvation, being crushed (including in burrows), internal parasites, disease, and being turned over onto their backs during fights or courtship (Luckenbach 1982, Turner *et al.* 1987). Free-roaming dogs cause mortality, injury, and harassment of desert tortoises (Evans 2001). Population models indicate that for a stable population to maintain its stability, on average, no more than 25 percent of the juveniles and 2 percent of the adults can die each year (Congdon *et al.* 1993, Service 1994). However, adult mortality at one site in the western Mojave Desert was 90 percent over a 13-year period (Berry 1997). Morafka *et al.* (1997) reported 32 percent mortality over 5 years among free-ranging and semi-captive hatchling and juvenile desert tortoises (up to 5 years old) in the western Mojave Desert. When the 26 that were known to have been preyed on by ravens were removed from the analysis, mortality dropped to 24 percent. Turner *et al.* (1987) reported an average annual mortality rate of 19 to 22 percent among juveniles over a 9-year period in the eastern Mojave Desert.

Declines in desert tortoise abundance appear to correspond with increased incidence of disease in some desert tortoise populations. The Goffs permanent study plot in Ivanpah Valley, California, suffered 92 to 96 percent decreases in desert tortoise density between 1994 and 2000 (Berry 2003). The high prevalence of disease in Goffs desert tortoises likely contributed to this decline (Christopher *et al.* 2003). Upper respiratory tract disease has not yet been detected at permanent study plots in the Colorado Desert of California, but is prevalent at study plots across the rest of the species' range (Berry 2003) and has been shown to be a contributing factor in population declines in the western Mojave Desert (Brown *et al.* 2002; Christopher *et al.* 2003). High mortality rates at permanent study plots in the northeastern and eastern Mojave Desert appear to be associated with incidence of shell diseases in desert tortoises (Jacobson *et al.* 1994). Low levels of shell diseases were detected in many populations when the plots were first established, but were found to increase during the 1980s and 1990s (Jacobson *et al.* 1994; Christopher *et al.* 2003). A herpesvirus has recently been discovered in desert tortoises, but little is known about its effects on desert tortoise populations at this time (Berry *et al.* 2002; Origgi *et al.* 2002).

The general trend for desert tortoises within the California Desert is one of decline. Tracy *et al.* (2004) concluded that the apparent downward trend in desert tortoise populations in the western portion of the range that was identified at the time of listing is valid and ongoing. Results from other portions of the range were inconclusive, but recent surveys of some populations found too few desert tortoises to produce population estimates (*e.g.*, 2000 survey of the Beaver Dam Slope, Arizona), suggesting that declines may have occurred more broadly. Transects surveyed in the Western Mojave Recovery Unit that did not detect any sign over large areas of previously-occupied habitat, and the numerous carcasses found on permanent study plots provide evidence of a decline. During line distance sampling conducted in 8 DWMAs in California in 2003, 930 carcasses and 438 live desert tortoises were detected; more carcasses than live desert tortoises were detected in every study area (Woodman 2004). In 2004, workers conducting line distance sampling in California detected 1,796 carcasses and 534 live desert tortoises; more carcasses were detected than live desert tortoises in every study area (Woodman 2005). Below, we elaborate on patterns within each recovery unit.

a. Northeastern Mojave Recovery Unit

A kernel analysis was conducted in 2003-2004 for the desert tortoise (Tracy *et al.* 2004) as part of the reassessment of the 1994 Recovery Plan. The kernel analyses revealed several areas in which the kernel estimations for live desert tortoises and carcasses did not overlap. The pattern of non-overlapping kernels that is of greatest concern is those in which there were large areas where the kernels encompassed carcasses but not live animals. These regions represent areas within DWMAs where there were likely recent die-offs or declines in desert tortoise populations. The kernel analysis indicated large areas in the Piute-Eldorado Valley where there were carcasses but no live desert tortoises. For this entire area in 2001, there were 103 miles of transects walked, and a total of 6 live and 15 dead desert tortoises found, resulting in a live encounter rate of 0.06 desert tortoises per mile of transect for this area. This encounter rate was among the lowest that year for any of the areas sampled in the range of the Mojave desert tortoise (Tracy *et al.* 2004).

Results of desert tortoise surveys at three survey plots in Arizona indicate that all three sites have experienced significant die-offs. Six live desert tortoises were located in a 2001 survey of the Beaver Dam Slope Exclosure Plot (Walker and Woodman 2002). Three had definitive signs of URTD, and two of those also had lesions indicative of cutaneous dyskeratosis. Previous surveys of this plot detected 31 live desert tortoises in 1996, 20 live desert tortoises in 1989, and 19 live desert tortoises in 1980. The 2001 survey report indicated that it is likely that there is no longer a reproductively viable population of desert tortoises on this study plot. Thirty-seven live desert tortoises were located in a 2002 survey of the Littlefield Plot (Young *et al.* 2002). None had definitive signs of URTD. Twenty-three desert tortoises had lesions indicative of cutaneous dyskeratosis. Previous surveys of this plot detected 80 live desert tortoises in 1998 and 46 live desert tortoises in 1993. The survey report indicated that the site might be in the middle of a die-off due to the high number of carcasses found since the site was last surveyed in 1998. Nine live desert tortoises were located during the mark phase of a 2003 survey of the Virgin Slope Plot (Goodlett and Woodman 2003). The surveyors determined that the confidence intervals of the population estimate would be excessively wide and not lead to an accurate population estimate, so the recapture phase was not conducted. One desert tortoise had definitive signs of URTD. Seven desert tortoises had lesions indicative of cutaneous dyskeratosis. Previous surveys of this plot detected 41 live desert tortoises in 1997 and 15 live desert tortoises in 1992. The survey report indicated that the site may be at the end of a die-off that began around 1996-1997.

b. Eastern Mojave Recovery Unit

The permanent study plot in the Ivanpah Valley is the only such plot in this DWMA; consequently, we cite information from that plot herein, although it is located within the Mojave National Preserve. Data on desert tortoises on a permanent study plot in this area were collected in 1980, 1986, 1990, and 1994; the densities of desert tortoises of all sizes per square mile were 386, 393, 249, and 164, respectively (Berry 1996).

The Shadow Valley DWMA lies north of the Mojave National Preserve and west of the Clark Mountains. It occupies approximately 101,355 acres. Data on desert tortoises on a permanent study plot in this area were collected in 1988 and 1992; the densities of desert tortoises of all sizes per square mile were 50 and 58, respectively (Berry 1996).

The Piute-Fenner DWMA lies to the east of the southeast portion of the Mojave National Preserve. It occupies approximately 173,850 acres. The permanent study plot at Goffs is the only such plot in this DWMA; consequently, we cite information from that plot herein, although it is located within the Mojave National Preserve. Data on desert tortoises on the permanent study plot were collected in 1980, 1990, and 1994; Berry (1996) estimated the densities of desert tortoises of all sizes at approximately 440, 362, and 447 individuals per square mile, respectively. As Berry (1996) noted, these data seem to indicate that this area supported "one of the more stable, high density populations" of desert tortoises within the United States. Berry (1996) also noted that "a high proportion of the desert tortoises (had) shell lesions." In 2000, only 30 live desert tortoises were found; Berry (2003) estimated the density of desert tortoises at approximately 88 desert tortoises per square mile. The shell and skeletal remains of approximately 393 desert tortoises were collected; most of these desert tortoises died between 1994 and 2000. Most of the desert tortoises exhibited signs of shell lesions; three salvaged desert tortoises showed abnormalities in the liver and other organs and signs of shell lesions. None of the three salvaged desert tortoises tested positive for upper respiratory tract disease.

Ivanpah and Piute-Eldorado valleys contained study plots that were analyzed in the Eastern Mojave Recovery Unit analysis. While there was no overall statistical trend in adult density over time, the 2000 survey at Goffs and the 2002 survey at Shadow Valley indicate low densities of adult desert tortoises relative to earlier years. Unfortunately, there are no data in the latter years for all five study plots within this recovery unit, and therefore, while there is no statistical trend in adult densities, we cannot conclude that desert tortoises have not experienced recent declines in this area. The probability of finding a carcass on a distance sampling transect was considerably higher for Ivanpah, Chemehuevi, Fenner, and Piute-Eldorado, which make up the Eastern Mojave Recovery Unit.

c. Northern Colorado Recovery Unit

Two permanent study plots are located within the Chemehuevi DWMA. At the Chemehuevi Valley and Wash plot, 257 and 235 desert tortoises were registered in 1988 and 1992, respectively (Berry 1999). During the 1999 spring survey, only 38 live desert tortoises were found. The shell and skeletal remains of at least 327 desert tortoises were collected; most, if not all, of these desert tortoises died between 1992 and 1999. The frequency of shell lesions and nutritional deficiencies appeared to be increasing and may be related to the mortalities.

The Upper Ward Valley permanent study plot was surveyed in 1980, 1987, 1991, and 1995; Berry (1996) estimated the densities of desert tortoises of all sizes at approximately 437, 199, 273, and 447 individuals per square mile, respectively.

d. Eastern Colorado Recovery Unit

Two permanent study plots are located within this DWMA. At the Chuckwalla Bench plot, Berry (1996) calculated approximate densities of 578, 396, 167, 160, and 182 desert tortoises per square mile in 1979, 1982, 1988, 1990, and 1992, respectively. At the Chuckwalla Valley plot, Berry (1996) calculated approximate densities of 163, 181, and 73 desert tortoises per square mile in 1980, 1987, and 1991, respectively. Tracy *et al.* (2004) concluded that these data show a statistically significant decline in the number of adult desert tortoises over time; they further postulate that the decline on the Chuckwalla Bench plot seemed to be responsible for the overall significant decline within the recovery unit.

The kernel analysis of the Eastern Colorado Recovery Unit shows that the distributions of the living desert tortoises and carcasses overlap for most of the region. The Chuckwalla Bench study plot occurs outside the study area, which creates a problem in evaluating what may be occurring in that area of the recovery unit. However, the few transects walked in that portion of the DWMA yielded no observations of live or dead desert tortoises. This illustrates our concern for drawing conclusions from areas represented by too few study plots and leaves us with guarded concern for this region. The percentage of transects with live desert tortoises was relatively high for most DWMAs within the Eastern Colorado Recovery Unit. In addition, the ratio of carcasses to live desert tortoises was low within this recovery unit relative to others.

e. Western Mojave Recovery Unit

This recovery unit includes the Pinto Mountains, Ord-Rodman, Superior-Cronese, and Fremont-Kramer DWMAs. Based on areas sampled within the Western Mojave Recovery Unit (Service 2009b), we estimate 43,701 desert tortoises (with a 95 percent confident interval of 24,361 to 79,126 tortoises) occur in this recovery unit.

The 117,016-acre Pinto Mountains DWMA is located in the southeastern portion of the Western Mojave Recovery Unit. No permanent study plots are located in this proposed DWMA. Little information exists on the densities of desert tortoises in this area. Tracy *et al.* (2004) noted that the distribution of carcasses and live desert tortoises appeared to be what one would expect in a "normal" population of desert tortoises; that is, carcasses occurred in the same areas as live desert tortoises and were not found in extensive areas in the absence of live desert tortoises.

The Ord-Rodman DWMA is located to the southeast of the city of Barstow and covers approximately 247,080 acres. The 1994 Recovery Plan notes that the estimated density of desert tortoises in this area is 5 to 150 desert tortoises per square mile (Service 1994). Three permanent study plots are located within and near this proposed DWMA.

The Superior-Cronese DWMA is located north of the Ord-Rodman DWMA; two interstate freeways and rural, urban, and agricultural development separate them. This DWMA covers 629,389 acres. No permanent study plots have been established in this area; the density of desert tortoises has been estimated through numerous triangular transects and line distance sampling efforts. This DWMA supports densities of approximately 20 to 250 desert tortoises per square mile (Service 1994).

The Fremont-Kramer DWMA is located west of the Superior-Cronese DWMA; the two DWMAs are contiguous and cover approximately 511,901 acres. The 1994 Recovery Plan notes that the estimated density of desert tortoises in this area was 5 to 100 desert tortoises per square mile (Service 1994). Berry (1996) notes that the overall trend in this proposed DWMA is "a steep, downward decline" and identifies predation by common ravens and domestic dogs, off-road vehicle activity, illegal collecting, upper respiratory tract disease, and environmental contaminants as contributing factors.

During the summers of 1998 and 1999, BLM funded surveys of over 1,200 transects over a large area of the western Mojave Desert. These transects failed to detect sign of desert tortoises in areas where they were previously considered to be common. Although these data have not been fully analyzed and compared with previously existing information, they strongly suggest that the number of desert tortoises has declined substantially over large areas of the western Mojave Desert. The Desert Tortoise Recovery Plan Assessment Committee also noted that the Western Mojave Recovery Unit has experienced declines in the number of desert tortoises (Tracy *et al.* 2004).

The Western Mojave Recovery Unit has experienced marked population declines as indicated in the 1994 Recovery Plan and continues today. Spatial analyses of this Recovery Unit show areas with increased probabilities of encountering dead rather than live animals, areas where kernel estimates for carcasses exist in the absence of live animals, and extensive regions where there are clusters of carcasses where there are no clusters of live animals. Collectively, these analyses point generally toward the same areas within the Western Mojave Recovery Unit, namely the northern portion of the Fremont-Kramer DWMA and the northwestern part of the Superior-Cronese DWMA. Together, these independent analyses, based on different combinations of data, all suggest the same conclusion for the Western Mojave. Data are not currently available with sufficient detail for most of the range of the desert tortoise with the exception of the Western Mojave Recovery Unit (Tracy *et al.* 2004).

f. Upper Virgin River Recovery Unit

The 1994 Recovery Plan states that desert tortoises occur in densities of up to 250 adult desert tortoises per square mile within small areas of this recovery unit; overall, the area supports a mosaic of areas supporting high and low densities of desert tortoises (Service 1994). The Utah Division of Wildlife Resources (UDWR) has intensively monitored desert tortoises, using a distance sampling technique, since 1998. Monitoring in 2003 indicated that the density of desert tortoises was approximately 44 per square mile throughout the reserve. This density represents a 41 percent decline since monitoring began in 1998 (McLuckie *et al.* 2006). The report notes that the majority of desert tortoises that died within one year (n=64) were found in areas with relatively high densities; the remains showed no evidence of predation.

In the summer of 2005, approximately 10,446 acres of desert tortoise habitat burned in the Red Cliffs Desert Reserve. The UDWR estimated that as many as 37.5 percent of adult desert tortoises may have died as a direct result of the fires (McLuckie *et al.* 2006).

Summary

Density estimates of adult tortoises varied among recovery units and years. Over the first six years of range-wide monitoring (2001-2005, 2007), tortoises were least abundant in the Northeast Mojave Recovery Unit (1 to 3.7 tortoises per kilometer^2 [2 to 10 tortoises per mile^2]; Service 2009b), and the highest reported densities occurred in the Upper Virgin River Recovery Unit (15 to 27 tortoises per kilometer^2 [38 to 69 tortoises per mile^2]; McLuckie *et al.* 2007). Considerable decreases in density were reported in 2003 in the Eastern Colorado and Western Mojave recovery units (Service 2006). However, the variability between annual estimates among all years is consistent with variability due to sampling between years; only after several years of consistent patterns will the range-wide approach distinguish population trends from the variability due to sampling. Beyond noting that no range-wide population losses or gains were detected, inferences as to the meaning of these first years of data would be premature.

Please refer to *The Status of the Desert Tortoise* (Gopherus agassizii) *in the United States* (Berry 1984) and the *Desert Tortoise Recovery Plan Assessment* (Tracy *et al.* 2004) for a detailed description of the methods and population trend and distribution analyses described above. In addition, *Range-wide Monitoring of the Mojave Population of the Desert Tortoise: 2007 Annual Report* (Service 2009b) provides information regarding the current monitoring effort.

Based on information in the draft recovery plan (Service 2008), desert tortoise (Mojave population) is classified as a) at a moderate degree of threat, which, although increased since 1994, does not place the species at imminent risk of extinction; b) has a low potential for recovery, adjusted based on current uncertainties about various threats and our ability to manage them; c) is a listed population below the species level; and d) is in potential conflict with development or other forms of economic activity. We anticipate that implementation of the revised recovery plan will resolve key uncertainties about threats and management, thereby improving recovery potential.

7. Threats

The Service identified key threats when the Mojave population of the desert tortoise was emergency listed as endangered and subsequently listed as a threatened species, which remains valid today. The 1994 Recovery Plan discusses threats and developed recovery objectives to minimize their effects on the desert tortoise and allow the desert tortoise to recover. Since becoming listed under the Act, more information is available on threats to the desert tortoise with some threats such as wildfires and nonnative plants affecting large areas occupied by desert tortoises.

Nonnative plants continue to contribute towards overall degradation or habitat quality for the desert tortoise. Land managers and field scientists identified 116 species of nonnative plants in the Mojave and Colorado deserts (Brooks and Esque 2002). The proliferation of nonnative plant species has also contributed to an increase in fire frequency in desert tortoise habitat by providing sufficient fuel to carry fires, especially in the intershrub spaces that are mostly devoid of native vegetation (Service 1994; Brooks 1998; Brown and Minnich 1986). Changes in plant communities caused by nonnative plants and recurrent fire may negatively affect the desert tortoise by altering habitat structure and species composition of their food plants (Brooks and Esque 2002).

Changing ecological conditions as a result of natural events or human-caused activities may stress individual desert tortoises and result in a more severe clinical expression of URTD (Brown *et al.* 2002). For example, the proliferation of non-native plants within the range of the desert tortoise has had far-reaching impacts on desert tortoise populations. Desert tortoises have been documented to prefer native vegetation over non-natives (Tracy *et al.* 2004). Nonnative, annual plants in desert tortoise critical habitat in the western Mojave Desert were identified to compose over 60 percent of the annual biomass (Brooks 1998). The reduction in quantity and quality of forage may stress desert tortoises and make them more susceptible to drought- and disease-related mortality (Brown *et al.* 1994). Malnutrition has been associated with several disease outbreaks in other chelonians (Borysenko and Lewis 1979).

Numerous wildfires occurred in desert tortoise habitat across the range of the desert tortoise in 2005 due to abundant fuel from the proliferation of nonnative plant species after a very wet winter. These wildfires heavily impacted two of the six desert tortoise recovery units, burning almost 19 percent of desert tortoise habitat in the Upper Virgin River and 10 percent in the Northeastern Mojave (Table 1). There were no significant fires from 2007 to 2009 in this area. In the Upper Virgin River Recovery Unit, 19 percent of the Upper Virgin River CHU burned. In the Northeastern Mojave Recovery Unit, three CHUs were impacted: approximately 23 percent of the Beaver Dam Slope CHU burned, 13 percent of the Gold Butte-Pakoon CHU, and 4 percent of the Mormon Mesa CHU. Although it is known that desert tortoises were burned and killed by the wildfires, desert tortoise mortality estimates are not available. Recovery of these burned areas is likely to require decades.

Table 1. Area (hectares) of desert tortoise Critical Habitat burned in the Northeastern Mojave and Upper Virgin River recovery units unit during 2005*

Recovery Unit	Critical Habitat Unit	Total Area Burned	Percent Burned
Northeastern Mojave			
	Beaver Dam Slope	53,528	26
	Gold-Butte Pakoon	65,339	13
	Mormon Mesa	12,952	3
	non-Critical Habitat	404,685	-
Upper Virgin River			
	Upper Virgin River	10,557	19

*Complete data sources: NV fire data from BLM as a single 2005 file: *http://www.blm.gov/nv/st/en/prog/more_programs/geographic_sciences/gis/geospatial_data.html*; AZ fire data from Forest Service, part of historic files [cross referenced against BLM ADSO fire data]: *http://www.fs.fed.us/r3/gis/datasets.shtml*; UT fire data from BLM, as part of historic fires file: *http://www.blm.gov/ut/st/en/prog/more/geographic_information/gis_data_and_maps.print.html.*

Disease and raven predation have been considered important threats to the desert tortoise since its emergency listing in 1989. What is currently known with certainty about disease in the desert tortoise relates entirely to individual desert tortoises and not populations; virtually nothing is known about the demographic consequences of disease (Tracy *et al.* 2004). Disease was identified in the 1994 Recovery Plan as an important threat to the desert tortoise. Disease is a natural phenomenon in wild populations of desert tortoises and can contribute to population declines by increasing mortality and reducing reproduction. However, URTD appears to be a complex, multi-factorial disease interacting with other stressors to affect desert tortoises (Brown *et al.* 2002; Tracy *et al.* 2004). The disease probably occurs mostly in relatively dense desert tortoise populations, as mycoplasmal infections are dependent upon higher densities of the host (Tracy *et al.* 2004).

From 1969 to 2004 the numbers of common ravens in the West Mojave Desert increased approximately 700 percent (Boarman and Kristan 2006). Population increases have also been noted at other locations particularly in the California Desert. This many-fold increase above historic levels and a shift from a migratory species to a resident species is due in large part to recent human subsidies of food, water, and nest sites (Knight *et al.* 1993, Boarman 1993, Boarman and Berry 1995). While not all ravens may include desert tortoises as significant components of their diets, these birds are highly opportunistic in their feeding patterns and concentrate on easily available seasonal food sources, such as juvenile desert tortoises.

Boarman (2002) identified the following major categories of threats: Agriculture, collection by humans, construction activities, disease, drought, energy and mineral development, fire, garbage and litter, handling and deliberate manipulation of desert tortoises, invasive or nonnative plants, landfills, livestock grazing, military operations, noise and vibration, OHV activities, predation, non-off-road vehicle recreation, roads, highways and railroads, utility corridors, vandalism, and wild horses and burros. For additional information on threats to the desert tortoise refer to Boarman (2002), Tracy *et al.* (2004), and Service (2008).

E. ENVIRONMENTAL BASELINE

The action area is defined as all areas to be affected directly or indirectly by the Federal action, including interrelated and interdependent actions, and not merely the immediate area involved in the action (50 CFR § 402.02). Subsequent analyses of the environmental baseline, effects of the action, cumulative effects, and levels of incidental take are based upon the action area as determined by the Service.

The action area for this project includes the project area (disturbance footprint, the right-of-way grant area, and access roads).

1. Status of the Desert Tortoise in the Action Area

The project is located in the Amargosa Desert which is not within designated critical habitat for the desert tortoise. Elevations within the project area range from 2,358 to 2,500 feet above mean sea level (amsl). The mean annual precipitation is about 2 to 4 inches, and the mean annual temperatures range from 42° to 60° F (Claassen 1985).

Soils are generally characterized as well-drained secondary soils with low to very low available water holding capacity (Tierra Data 2009). These soils are weathered from bedrock on the mountains, medium to coarse textured soils on alluvial fans and terraces and fine-grained, alluvial soils on the valley floors. Specifically, there are four soil map units described for the project including, (1) Yermo, hot-Yermo-Arizo association, (2) Shamock gravelly fine sandy loam, 2 to 4 percent slopes, (3) Sanwell-Sanwell, warm-Yermo association, and (4) Lewdlac-Yermo association (NRCS 2009).

Within the creosote bush series of Mojave desert scrub there are a variety of plant communities possessing some distinctive Mojave associates. In the project area, *Larrea tridentata-Ambrosia dumosa, Larrea tridentata-Atriplex polycarpa, Larrea tridentata-Lepidium fremontii,* and *Larrea tridentata-Ambrosia dumosa-Atriplex polycarpa* are the co-dominant associations (Tierra Data 2009). In the project area, *Larrea tridentata-Ambrosia dumosa* association is found on mostly flat, gravelly desert pavement with herbaceous growth limited to beneath the shrub canopies or in close proximity. Primroses, *Brassica* spp. and desert puffballs are occasionally seen. Wildlife is more diverse and abundant in this association than others within the series including, numerous lizards, jackrabbits, rodents, and burro sign. The only desert tortoise burrows observed in biologic surveys for this project were found in this association (Tierra Data 2009). The second association is *Larrea tridentata-Atriplex polycarpa* and is located primarily in the southern portion of the Project area. The variety of herbaceous plants are similar to those in creosote bush-white bursage (=burrobush) association, but is distributed more sparsely. The

Larrea tridentata-Lepidium fremontii association occurs in isolated small patches primarily in the northeastern portion of the project. The overall shrub canopy is much lower than in the other associations, with less herbaceous cover distributed throughout. Finally, *Larrea tridentata-Ambrosia dumosa-Atriplex polycarpa* occurs in a few small patches on the west end of the project area.

In addition to the upland plant communities noted above, two wetland biomes occupy narrow strips along margins and bottoms of many washes that traverse the uplands. These are the riparian scrublands along the periphery of washes and the interior strand along the sandy/gravelly wash bottoms. Within riparian corridors, the vegetation is similar to adjacent upland vegetation but occurs more abundantly and denser. Riparian trees include desert willow (*Chilopsis linearis*) and catclaw (*Acacia greggii*), the shrubs are generally the same as those found in the uplands, but cheesebush, also called white burrobrush (*Hymenoclea salsola*), occurs on rare occasions along the wash banks. Along the well-defined banks of Fortymile Wash, *Atriplex polycarpa* occurs more abundantly than in the uplands (Tierra Data 2009).

Desert tortoise surveys were conducted within the footprint of the proposed project from late March through May 2009 (Tierra Data 2009) using Service approved protocols (Service 2010a). Four Class 4 burrows were observed on the 7,670 acres surveyed during a time when tortoises would have been most active (Figure 3-2 in the biological assessment [BLM 2010b]). Class 4 burrows are burrows with deteriorated condition that probably are used by desert tortoises. No dead or live tortoises were observed nor were any shells, scutes or bone segments of dead tortoises detected in washes or ponding areas during high water events. Desert tortoise surveys conducted in 2006 (Knight and Leavitt 2006) and in 2007 (Converse Consultants 2008) approximately 25 miles northwest of the project area near Beatty, Nevada indicate population densities of 0-10 tortoise per square mile. Extensive surveys for desert tortoise on the Nevada Test Site (Department of Energy), located approximately 15 miles northeast of the project, have indicated low to very low densities of desert tortoise (Rautenstrauch and O'Farrell 1994). Various surveys south and east of the project site, in Pahrump Valley, also indicated low densities of desert tortoise (Tierra Data 2009). Using this information, the Service estimates that up to four desert tortoises occur within the action area.

Based on this low occurrence of desert tortoise within the action area, we do not expect that the proposed project site is likely to contain desert tortoise eggs.

2. Factors Affecting the Species in the Action Area

Although the land throughout the project site is undeveloped desert alluvial valley, no desert tortoises or sign (except deteriorated burrows) were observed within the project footprint. The project site would be located near, or cross through, a variety of land use types such secondary and unimproved roads, trails, pipelines, electrical transmission lines, utility corridors, and other facilities developed around the Amargosa Farms community. Development on adjacent lands has resulted in habitat loss, degradation, and fragmentation for the local desert tortoise population, as well as increased harm and harassment of desert tortoises. Illegal dumping and off-road recreation continue to contribute to the cumulative degradation of biological resources in the area. Additional threats include illegal collection of tortoises as pets, vandalism (shooting, crushing or mutilation), and roadkill mortality (Service 1994).

F. Effects of the Proposed Actions on the Species

Direct effects are the immediate, often obvious effect of the proposed action on the desert tortoise or its habitat. Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur. If an effect will occur whether or not the action takes place, the action is not an essential cause of the indirect effect. In contrast to direct effects, indirect effects can often be more subtle, and may affect desert tortoise populations and habitat quality over an extended period of time, long after project activities have been completed. Indirect effects are of particular concern for long-lived species such as the desert tortoise, because project-related effects may not become evident in individuals or populations until years later.

Project activities could result in direct mortality, injury, or harassment of individuals as a result of encounters with vehicles or heavy equipment. Also, desert tortoises may take shelter under parked vehicles and be killed, injured, or harassed when vehicles are moved. Other direct effects could include individual desert tortoises or their eggs being crushed or entombed in burrows. Desert tortoises may be collected or vandalized. Construction and operation of facilities may disrupt desert tortoise behavior due to noise or vibrations from the heavy equipment. Desert tortoises may be to injured and killed as a result of encounters with workers' and visitors' pets. If trash is not properly disposed, trash items may attract desert tortoise predators such as ravens and coyotes. Desert tortoises also may be attracted to the construction area by application of water to control dust, placing them at higher risk of injury and mortality. Measures proposed by BLM to ensure that: (1) biological clearances are conducted and all desert tortoises within the project footprint are translocated and (2) permanent fencing is constructed and maintained around the project area, combined with the low number of desert tortoises in the project area, should minimize or avoid these potential effects.

Installation of the exclusionary fencing around the solar field could result in direct effects such as mortality, injury, or harassment of desert tortoises from equipment operation, installation activities, and removal of desert tortoise burrows. The fencing would preclude desert tortoises from re-entering or leaving if not found and removed during the clearance survey. Fencing would result in fragmentation of habitat and individual home ranges. During construction and operation, breaches in the exclusionary fencing may allow desert tortoises to pass through the barrier and be affected by project-related activities. Measures proposed by BLM to ensure that: (1) biological clearances are conducted and all desert tortoises within the project footprint are translocated, (2) fencing is constructed and maintained around the project area, and (3) timely repair of the fencing is conducted, combined with the low number of desert tortoises in the project area, should minimize or avoid these potential effects.

Capturing, handling, and translocating desert tortoises from the proposed site after the installation of the fencing would result in harassment and also may result in death or injury. Desert tortoises may die or become injured by capture and relocation/translocation if these methods are performed improperly, particularly during extreme temperatures, or if they void their bladders. Averill-Murray (2001) determined that desert tortoises that voided their bladders during handling had significantly lower overall survival rates (0.81-0.88) than those that did not void (0.96). If multiple desert tortoises are handled by biologists without the use of appropriate protective measures and procedures, such as reused latex gloves, pathogens may be spread among the desert tortoises. Walde *et al.* (2008) found that the differences in reproduction among translocated, resident, and control desert tortoises were "not likely to be statistically significant" in a study of desert tortoises at Fort Irwin. Measures proposed by BLM to ensure that: (1) Service-approved guidelines are followed when desert tortoises are handled and (2) all personnel handling desert tortoises are authorized desert tortoise biologists, should minimize or avoid these potential effects.

Hazardous materials and wastes pose potential threats to desert tortoises. Measures proposed by BLM to ensure that a waste management plan and spill prevention plan are implemented should minimize or avoid these potential effects.

Fire poses a threat to desert tortoise habitat. Construction activities and operation and maintenance activities could result in accidental fires that spread into adjacent desert tortoise habitat. Measures proposed by BLM to ensure that a fire protection system is installed should minimize or avoid these potential effects.

Project equipment may transport weeds into the project area where they may become established. Habitat quality would be reduced with the potential introduction of invasive plant species and compaction of soils. Additionally, the introduction of noxious weeds may lead to increased wildfire risk (Brooks *et al.* 2003). Measures proposed by BLM to ensure that weeds are controlled at the proposed project site should minimize or avoid these potential effects.

Human activities may provide food in the form of trash and litter or water that attracts desert tortoise predators such as the common raven, desert kit fox, feral dogs, and coyote (Berry 1986a; BLM 1990). Measures proposed by BLM to ensure a litter program is implemented and all trash removed daily should minimize or avoid these potential effects.

Facility infrastructure such as power poles could provide perching and nesting opportunities for ravens. Natural predation rates may be altered or increased when natural habitats are disturbed or modified. Common raven populations in some areas of the Mojave Desert have increased 1,500 percent from 1968 to 1988 in response to expanding human use of the desert (Boarman 2002). Since ravens were scarce in the Mojave Desert prior to 1940, the current level of raven predation on juvenile desert tortoises is considered to be an unnatural occurrence (BLM 1990). No new transmission lines proposed to be constructed by Solar Millennium at this time.

In addition to ravens, feral dogs have emerged as significant predators of the tortoise. Feral dogs may range several miles into the desert and have been observed digging up and killing desert tortoises (Service 1994, Evans 2001). There are no reports of feral dogs in this area.

Domestic dogs brought to the project site by visitors may harass, injure, or kill desert tortoises, particularly if allowed off-leash to roam freely in occupied desert tortoise habitat (Service 1994, Evans 2001). Measures proposed by BLM to ensure that: (1) biological clearances are conducted and all desert tortoises within the project footprint are translocated and (2) permanent fencing is constructed and maintained around the project area, combined with the low number of desert tortoises in the project area, should minimize or avoid these potential effects.

The project would result in the loss of 4,350 acres of desert tortoise habitat. Removal of habitat within the home range of a desert tortoise or segregating individuals from their home range (loss of connectivity) with a fence would likely result in displacement stress that could result in loss of health, increased risk of predation, and death. Measures proposed by BLM should ensure these potential effects are minimized or avoided: Service-approved translocation guidelines would be followed and adaptive management strategies would be implemented.

For gene flow to occur across the range, populations of tortoises need to be connected across the range by occupied areas of habitat that contain sustainable numbers of tortoises. Desert tortoise population genetic and distribution studies provide evidence that desert tortoises breed with their neighbors, and those tortoises breed with their neighbors, and so on. Removal of 4,350 acres of tortoise habitat would further limit movement of tortoises within the landscape; however, tortoises that occur within the action area would be placed in an area adjacent to the project and would still be able to contribute to gene flow in the area.

Disturbance of 4,350 acres will result in the direct loss of habitat for all tortoises that occur on these acres and will no longer be available to tortoises in adjacent habitat that may use the project area for foraging, breeding, or sheltering. In addition to the immediate and short-term effects to desert tortoises in the action area, the direct loss of habitat at the site precludes the use of this habitat by all future generations of tortoises that would have otherwise been recruited within and occupied the site. Translocation of tortoises into adjacent habitat would minimize this effect by allowing displaced tortoises to remain in the population and contribute towards recovery of the species.

Following release, desert tortoises may suffer a higher potential for mortality because they are moving great distances through unfamiliar territory, and are less likely to have established cover sites for protection prior to home range establishment. Studies have documented various sources of mortality for translocated individuals, including predation, exposure, fire, disease, crushing by cattle, and flooding (Nussear 2004; Field *et al.* 2007; Berry 1986b; U.S. Army 2009; U.S. Army 2010). We cannot predict the distances or direction that translocated desert tortoises are likely to move. The degree to which these desert tortoises expand the area they use depends on whether the translocated desert tortoises are released into typical or atypical habitat; that is, if the translocation area supports habitat that is similar to that of the source area, desert tortoises are likely to move less (Nussear 2004). In one study, the majority of the dispersal movement away from the release site occurred during the first two weeks after translocation (Field *et al.* 2007). However, Field *et al.* (2007) and Nussear (2004) showed translocated desert tortoises appear to reduce movement distances following their first post-translocation hibernation to a level that is not significantly different from resident populations. Translocation studies, including a study performed in the Ivanpah Valley, have shown that straight-line movement distances following release can be over 3.73 miles in the first year for some desert tortoises (Berry 1986b; Field *et al.* 2007; Nussear 2004). Mean dispersal distances observed on three study plots south of Fort Irwin ranged from 153 to 6,168 yards, with maximum dispersal distances of between 13,795 to 25,155 yards (Walde *et al.* 2008). Measures proposed by BLM to ensure that: Service-approved translocation guidelines are followed, combined with the low abundance of desert tortoises in the project area, should minimize these effects.

Translocated desert tortoises from the construction area would be moved into areas already supporting other desert tortoises. The Service and NDOW will determine the recipient sites for the translocated tortoises. As a result, there could be increased competition for forage; especially during drought years. Increased desert tortoise densities may lead to increased inter-specific encounters and thereby increase the potential for spread of disease and potentially reduce the overall health of the population. Increased desert tortoise densities could also lead to increased competition for shelter sites and other resources or increased incidence of aggressive interactions between individuals (Saethre *et al.* 2003). Measures proposed by BLM to ensure that: (1) Service-approved translocation guidelines are followed and (2) adaptive management strategies are implemented, combined with the low abundance of desert tortoises in the project area, should minimize these effects.

In a study conducted in Ivanpah Valley, 21.4 percent of 28 translocated desert tortoises died (Field *et al.* 2007). Other studies have documented mortality rates of 0, 15, and 21 percent in other areas (Nussear 2004). However, Nussear (2004) found that mortality among translocated desert tortoises was not statistically different from mortality observed in resident populations, but mortality rates in resident populations were not compared to those in control groups; therefore, we cannot determine if the translocation caused increased mortality rates in the resident population. Recent work on translocation associated with the expansion of Fort Irwin (U.S. Army 2009; U.S. Army 2010) compared the mortality rates associated with resident and translocated populations with that of the control populations and indicates that translocation does not increase mortality above natural levels (Esque *et al.* 2010). We estimate that most tortoise mortality is likely to occur in the first year after release. After the first year, the individuals in the translocated population are likely to settle into new home ranges and mortality is likely to decrease.

G. CUMULATIVE EFFECTS

Cumulative effects are those effects of future non-Federal (State, tribal, local government, or private) activities that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

In general, actions on private lands within and adjacent to Amargosa Farms, Nevada are expected to continue to increase in proportion to increases in the human populations and access in these areas. Increased development would cause continued habitat loss, degradation, and fragmentation for the local desert tortoise population; as well as increased harm and harassment of individual desert tortoises, contributing to the cumulative degradation of the area. Planned future actions, such as future industrial solar power plants, would likely continue this trend. The Service determines that most other future actions in the action area would likely require section 7 consultation since the action area is managed by BLM, a Federal agency.

H. CONCLUSION

After reviewing its status, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the desert tortoise. We have reached this conclusion because:

1. Solar Millennium will implement numerous measures to ensure that tortoises are located and translocated, potential desert tortoise injury and mortality is minimized, and reduce the potential that desert tortoises will occupy project work sites (i.e., clearance surveys, exclusion fencing, translocation, qualified desert tortoise biologists, desert tortoise monitors).

2. The number of desert tortoises likely to be injured and killed as a result of translocation will likely to be small relative to the number of desert tortoises that occur across the range of the species.

3. Solar Millennium will implement measures to reduce the potential for increased predation by common ravens and spread of non-native plant species.

4. Current information from permanent study plots and line distance sampling does not document a statistical trend in adult desert tortoise densities in this recovery unit. Therefore, we have no information to indicate that the loss of a small number of individuals as a result of this project would appreciably reduce our ability to reach population recovery objectives for the desert tortoise in the Recovery Unit or for the species rangewide.

5. This project would not result in loss of desert tortoise habitat in areas or connectivity between areas that BLM or other agencies have designated for intensive management to achieve conservation of desert tortoises.

While the project will reduce the amount of available desert tortoise habitat, sufficient habitat will remain to provide connectivity of tortoise habitat. Translocation of desert tortoises into habitat adjacent to the project area will increase tortoise numbers in those adjacent areas and potentially enhance gene flow within the population.

The project would remove habitat on the project site from current and future generations of tortoises that would occur in the area. Successful translocation of displaced tortoises would minimize these effects by allowing those tortoises to remain in the population and contribute towards recovery of the species.

6. Compensation funds provided to BLM are anticipated to result in an increase in the quality of habitat managed for the conservation of the desert tortoise through restoration of degraded habitat.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of an incidental take statement.

The Terms and Conditions may include: (1) restating measures proposed by BLM; (2) modifying the measures proposed by BLM; or (3) specifying additional measures considered necessary by the Service. Where these Terms and Conditions vary from or contradict the minimization measures proposed under the Description of the Proposed Action, specifications in these Terms and Conditions shall apply. The measures described below are nondiscretionary and must be implemented by the BLM, or other jurisdictional Federal agencies, so that they become binding conditions of any project, contract, grant, or permit issued by BLM as appropriate, in order for the exemption in section 7(o)(2) to apply. Other jurisdictional Federal agencies may include the U.S. Army Corps of Engineers (for a permit under the Clean Water Act), the U.S. Department of Treasury (partial funding provided through the American Recovery and Reinvestment Act), and the Federal Communications Commission (for operation of a two-way radio communications system). The Service's evaluation of the effects of the proposed action includes consideration of the measures developed by BLM, and repeated in the *Description of the Proposed Action* portion of this biological opinion, to minimize the adverse effects of the proposed action on the desert tortoise. Any subsequent changes in the minimization measures proposed by BLM, or other jurisdictional federal agencies, may constitute a modification of the proposed action and may warrant reinitiation of formal consultation, as specified at 50 CFR § 402.16. These reasonable and prudent measures are intended to clarify or supplement the protective measures that were proposed by BLM as part of the proposed action.

The BLM, and other jurisdictional federal agencies, have a continuing duty to regulate the activities covered by the incidental take statement in the biological opinion. If BLM , or other jurisdictional Federal agencies, fail to include the terms and conditions of this incidental take statement as enforceable conditions of its discretionary action, the protective coverage of section 7(o)(2) may lapse. To monitor the effect of incidental take, BLM must report the progress of its action and its effects on the desert tortoise to the Service as specified in the incidental take statement [50 *Code of Federal Regulations* 402.14(i)(3)].

A. AMOUNT OR EXTENT OF TAKE ANTICIPATED

The Service determined that some of the incidental take of the desert tortoise will be difficult to detect or quantify. As discussed previously, we do not expect any desert tortoise eggs to be present on the site. Should the extent of habitat disturbance or the number of tortoise injuries or mortalities exceed those in our assessment, reinitiation of consultation would be required. Destruction of any desert tortoise outside the project footprint resulting from this project would also constitute a reinitiation trigger.

Based on the analysis of impacts provided above, measures proposed by BLM, and the anticipated project duration, the Service anticipates that the following take could occur as a result of the proposed action:

1. Capture and Translocation of Desert Tortoises

Based on the best available information, no more than **four** subadult and adult desert tortoises would be captured and translocated. It is unknown how many juvenile and hatchling desert tortoises would be detected, but all juvenile and hatchling desert tortoises that are detected within the fenced perimeter, access roads, and pipelines would be captured and translocated. Following capture and translocation, we anticipate mortality of translocated desert tortoises to be similar to the mortality of resident desert tortoises.

2. Construction of Facilities

Solar Millennium would fence its work areas with desert tortoise exclusion fencing, perform clearance surveys on all work areas, and implement numerous measures to prevent adverse effects to desert tortoises. Consequently, we anticipate that construction activities at project site, including pipelines and use of access routes, is unlikely to directly injure or kill any desert tortoises, but no more than **one** subadult and adult desert tortoise and an unknown number of hatchling and juvenile desert tortoises may be taken in the form of injury or mortality. We anticipate that all subadult and adult desert tortoises and juvenile and hatchling desert tortoises that are detected within the fenced perimeter, access roads, and pipelines, would be captured and translocated.

3. Operation and Maintenance of Project Facilities

Following fencing of project areas and project construction, operation and maintenance activities, including site access within permanently fenced areas are not likely to directly injure or kill any desert tortoises. However, all desert tortoises may not be detected during construction and may be detected during operation and maintenance activities (*e.g.,* a small hatchling desert tortoise may grow to a size that is easier to detect). It is unknown how many desert tortoises may be detected, but the project proponent would capture and translocate any desert tortoises detected. We include these animals within the take authorized during construction activities.

Maintenance activities located outside of fenced work areas would kill or injure few, if any, desert tortoises because these activities would be local and infrequent, not result in ground disturbance, and incorporate numerous protective measures to avoid adverse effects. The Service estimates that no desert tortoise injuries or mortalities will result from maintenance activities outside the fenced perimeter.

4. Decommissioning and Restoration of Facilities

After facility closure, Solar Millennium would conduct decommissioning activities and restoration of long-term disturbances within fenced areas. Because we do not have sufficient information regarding the method or extent of the decommissioning activities that may occur, we cannot determine the level of take associated with these activities. Consequently, we are not granting an exemption from the prohibitions against take for these activities. These actions would require reinitiating consultation.

B. Effect of Take

In the accompanying biological opinion, the Service has determined that this level of anticipated take will not jeopardize the continued existence of the desert tortoise.

Our evaluation of the proposed action includes consideration of the protective measures described in the *Description of the Proposed Action* section of the accompanying biological opinion. Consequently, any changes in these protective measures may constitute a modification of the proposed action that causes an effect to the desert tortoise that was not considered in the biological opinion and require reinitiation of consultation, pursuant to the implementing regulations of the section 7(a)(2) of the Act (50 CFR § 402.16).

C. Reasonable and Prudent Measures with Terms and Conditions

The Service believes that the Reasonable and Prudent Measures (RPMs) below are necessary and appropriate to minimize take of desert tortoise. In order to be exempt from the prohibitions of section 9 of the Act, the BLM, or other jurisdictional Federal agencies, must ensure full compliance with Terms and Conditions, which follow and implement the RPMs below. hese conditions are non-discretionary.

RPM 1: *The BLM, or other jurisdictional Federal agencies as appropriate, shall ensure that desert tortoises in harm's way are located, properly handled, translocated, monitored, and excluded from fenced project facilities.*

Terms and Conditions:

1.a. A desert tortoise education program shall be presented to all personnel onsite during construction activities. This program will contain information concerning the biology and distribution of the desert tortoise, its legal status and occurrence in the proposed project area, the definition of take and associated penalties, measures designed to minimize the effects of construction activities, the means by which employees can facilitate this process, and reporting requirements to be implemented when desert tortoises are encountered.

1.b. An authorized desert tortoise biologist (Service 2009a) shall be onsite during the desert tortoise active season for all construction activities to ensure compliance with this biological opinion, including avoidance of inadvertently harming any desert tortoises that may wander on to the construction site via unfenced areas.

The authorized desert tortoise biologist shall be responsible for: (1) enforcing the litter-control program; (2) ensuring that tortoise-proof fences are maintained where applicable; (3) ensuring that desert tortoise habitat disturbance is restricted to authorized areas; (4) ensuring that all equipment and materials are stored within the boundaries of the construction zone or within the boundaries of previously-disturbed areas; (5) ensuring that all vehicles associated with construction activities remain within the proposed construction zones; and (6) ensuring compliance with the Terms and Conditions of this biological opinion. Desert tortoises shall be handled according to Service-approved protocol (Service 2009a).

In accordance with *Procedures for Endangered Species Act Compliance for the Mojave Desert Tortoise* (Service 2009a), an authorized desert tortoise biologist shall possess a bachelor's degree in biology, ecology, wildlife biology, herpetology, or closely related fields. The biologist must have demonstrated prior field experience using accepted resource agency techniques to survey for desert tortoises and desert tortoise sign. In addition, the biologist shall have the ability to recognize and accurately record survey results.

1.c. A temporary, tortoise-proof fence shall be constructed and maintained around the project area until a permanent tortoise-proof fence is erected. An authorized desert tortoise biologist will be present at all times during fence construction. Temporary fencing along the highway will be completed before construction begins.

Fencing will consist of 1-inch horizontal by 2-inch vertical mesh. The tortoise-proof fencing will extend at least 18 inches aboveground and, where feasible, 6 inches below ground. In situations where it is not feasible to bury the fence, the lower 6-12 inches of the fence shall be bent at a 90-degree angle towards the potential direction of encounter with desert tortoise and covered with cobble or other suitable material to ensure that desert tortoises cannot dig underneath, thus creating gaps through which desert tortoises may traverse. The fence shall be inspected, and zero clearance maintained between the bottom of the fence and the ground as stated in the Terms and Conditions below.

1.d. Cattleguards shall be placed at all road access points, where desert tortoise-proof fencing is interrupted, to exclude desert tortoises from the road and entering the right-of-way. BLM, or other jurisdictional Federal agencies as appropriate, shall coordinate with the Service on placement and design of cattleguards and their connection with the fencing, to ensure that cattleguards provide a functional barrier to desert tortoise access to the road right-of-way.

1.e. After construction of the temporary tortoise-proof fence and before surface-disturbing activities, an authorized desert tortoise biologist shall conduct a clearance survey to locate and remove desert tortoises using techniques providing full coverage of all areas. Two passes of complete coverage will be accomplished. All desert tortoise burrows, and other species burrows that may be used by desert tortoises, will be examined to determine occupancy of each burrow by desert tortoises. Any desert tortoises or eggs found in the fence line will be relocated offsite by an authorized desert tortoise biologist in accordance with approved protocol (Service 2009a). Desert tortoise burrows that occur immediately outside of the fence alignment that can be avoided by fence construction activities shall be clearly marked or flagged to prevent crushing.

1.f. All burrows found within areas proposed for disturbance, whether occupied or vacant, shall be excavated by an authorized desert tortoise biologist and collapsed or blocked to prevent desert tortoise re-entry. All burrows will be excavated with hand tools to allow removal of desert tortoises or desert tortoise eggs. All desert tortoise handling and excavations, including nests, will be conducted by an authorized desert tortoise biologist in accordance with Service-approved protocol (Service 2009a).

1.g. All desert tortoises encountered at the project site shall be given unique identification numbers assigned by the Service in coordination with state wildlife agencies. A tracking device (*e.g.*, transmitter) must be affixed to each desert tortoise encountered. Prior to translocation, desert tortoises must be located, at a minimum, on a monthly basis.

1.h. After receiving concurrence with the results of complete health assessments, as well as approval of tortoise translocation recipient sites from the NDOW and the Service, an authorized biologist shall move desert tortoises found during clearance surveys to pre-selected locations outside the fenced perimeter no greater than 500 m from the location where the animal was found. Following Service guidance (Service 2010b), any animals that cannot be translocated within 500 m of where it was found will be translocated from the project site to the Desert Tortoise Conservation Center. Desert tortoises found aboveground will be placed under a bush in the shade. A desert tortoise located in a burrow will be placed in an existing unoccupied burrow of the same size and orientation as the one from which it was taken. If a suitable natural burrow is unavailable or the occupancy status of the burrow is in question, the authorized desert tortoise biologist will construct one of the same size and orientation as the one from which it was removed using the protocol for burrow construction in Section B-5-f (Service 2009a). Projected density after translocation (includes residents and translocated tortoises) must not exceed 130 percent of the mean density detected in the nearest recovery unit. Translocations shall not occur at times of severe environmental stress for desert tortoises. Minimally, this pertains to time of year, local/regional weather patterns, weather conditions during the proposed release event, and condition of the donor and recipient sites.

1.i. Permanent tortoise-proof fencing along the project area shall be appropriately constructed, monitored and maintained. During construction, fencing will be checked weekly during the desert tortoise active period (March 1 through October 31), and monthly during the desert tortoise inactive period and after major storm events. After the completion, fencing will be monitored on a quarterly basis and after major storm events, unless modified as directed by the Service. Repairs will be made in a timely manner upon discovery. Monitoring and maintenance shall include regular removal of trash and sediment accumulation and restoration of zero ground clearance between the ground and the bottom of the fence, including re-covering the bent portion of the fence if not buried.

1.j. Any desert tortoise found within one hour before nightfall shall be placed in a separate, clean cardboard box and held in a cool, predator-free location. The box will be covered and kept upright at all times to minimize stress to the tortoise.

Each box will be used once and then disposed properly. The desert tortoise will be released the next day in the same area from which it was collected and using the procedures described above. Each desert tortoise will be handled with new disposable latex gloves. After use, the gloves will be properly discarded and a fresh set used for each subsequent desert tortoise handling.

1.k. Project activities that may endanger a desert tortoise shall cease if a desert tortoise is found on the project site. Project activities will resume after an authorized desert tortoise biologist removes the desert tortoise from danger or after the desert tortoise has moved to a safe area.

RPM 2: *The BLM, or other jurisdictional Federal agencies as appropriate, shall ensure that translocation of desert tortoises does not result in spread of disease, or injury or mortality of translocated or resident desert tortoises; and mortality of monitored translocated, resident, and control animals are similar.*

Terms and Conditions:

2.a. If the desert tortoises will be monitored *in situ* (*i.e.*, in place) rather than removed during the survey, a tracking device (*e.g.*, transmitter) shall be affixed to each desert tortoise encountered during clearance the survey. If *ex situ* quarantine is chosen, the project proponent shall coordinate with a desert tortoise husbandry and disease prevention expert to design a facility and develop operating protocols to ensure that proper care and quarantine will be maintained. Quarantine facilities for individual desert tortoises removed during the clearance surveys must securely hold the desert tortoises from time of collection to ultimate disposition and provide for their health and wellbeing. The proponent must secure a certified caretaker and be approved by the Service and the state wildlife agency. Desert tortoises shall be monitored a minimum of once each month while awaiting translocation.

2.b. Health assessments shall be performed on all desert tortoises encountered during the population and clearance surveys for the project area All health assessments will include a physical inspection (*i.e.*, notation of clinical signs of acute disease infection; evidence of emaciation or dehydration; palpation for bladder stones; body mass and carapace measurements). For desert tortoises that would be moved greater than 500 m, complete health assessments will include disease testing via blood samples. No resident desert tortoises will be removed from the population unless requested by the Service. Health assessments must be conducted by individuals certified by the Service and state wildlife agency to conduct such assessments. If a desert tortoise being monitored *in situ* has a positive blood test result, all desert tortoises within 500 meters of the positive tortoise's initial and current locations must be retested in case it came into contact with the unhealthy desert tortoises while initial test results were pending. The positive desert tortoise must be removed from the project site and sent to the recovery center as described in Translocation Guidance (Service 2010b). The project proponent will pay the recovery center $9,000 for each tortoise sent to them for housing, care, treatment, and other services for five years ($3,000 for year one, $1,500 for years two-five). No additional funds will be requested from project proponents for tortoises remaining at the center after five years. The recovery center is operated by the San Diego Zoo under contract with the Service.

2.c. At the conclusion of the initial monitoring period, complete health assessments shall be conducted on all remaining monitored desert tortoises. Transmitters shall not be removed and monitoring concluded until the Service and the state wildlife agency have reviewed the health assessment data to determine that further adaptive management and monitoring are not required to ensure project impacts were minimized.

RPM 3: *The BLM, or other jurisdictional Federal agencies as appropriate, shall ensure implementation of measures to minimize predation on desert tortoises by ravens or other desert tortoise predators attracted to the project area.*

Terms and Conditions:

3.a. A litter control program shall be implemented to reduce the attractiveness of the area to opportunistic predators such as desert kit fox, coyotes, and common ravens. Trash and food items will be disposed of properly in predator-proof containers with re-sealing lids. Trash containers will be emptied and construction waste will be removed daily from the project area and disposed of in an approved landfill.

3.b. All project structures shall be designed to deter the perching and nesting of ravens.

3.c. An authorized biologist shall conduct monthly nest surveys of project facilities during the raven breeding season and document the presence of all nests and the species using them. During these monthly surveys, the authorized biologist will also document any sign of predation of desert tortoises below the nest and in the vicinity of the project. If sign of predation is found under a nest, it will be reported to BLM, who will immediately notify Wildlife Services personnel to handle the offender. All raven nests will be removed from project facilities by authorized personnel and the nesting material will be disposed of at least once per year when desert tortoises are least active.

RPM 4: *The BLM, or other jurisdictional Federal agencies as appropriate, shall ensure implementation of measures to minimize loss and long-term degradation and fragmentation of desert tortoise habitat, such as soil compaction, erosion,* *crushed vegetation, or introduction of non-native invasive plants or weeds as a result of project activities.*

Terms and Conditions:

4.a. All equipment, vehicles, and construction materials shall remain within the fenced right-of-way. Staging areas will be located in previously-disturbed areas whenever possible.

4.b. Cross-country travel and travel outside construction zones and fenced areas shall be prohibited.

4.c. Prior to surface-disturbing activities associated with the proposed project, BLM, or other jurisdictional Federal agencies as appropriate, shall collect remuneration fees for compensation of desert tortoise habitat loss. The BLM estimates that 4,350 acres of habitat will be disturbed. Total fees for disturbance of desert tortoise habitat within the material site and expansion area will be $3,366,900 ($774/acre x 4,350 acres).

If fees are paid after March 1 of the year, the rate will be indexed for inflation based on the Bureau of Labor Statistics Consumer Price Index for All Urban Consumers (CPI-U). Information on the CPI-U can be found on the internet at: *http://stats.bls.gov/news.release/cpi.nws.htm*.

The payments shall be accompanied by the enclosed Section 7 Fee Payment Form, and completed by the payee. Payment shall be by certified check or money order payable to the Bureau of Land Management.

Desert tortoise compensation funds shall be used for the sole purpose of implementing action(s) that benefits desert tortoise over time, including management and recovery in Nevada. Compensation funding will be used to fund the highest priority actions in Nevada. BLM and the Service will identify and give priority to actions that directly tie to the impacts that lead to the need for compensation.

4.d. The BLM and project proponent shall coordinate to salvage and relocate cacti, yuccas, and shrubs for onsite and offsite restoration efforts.

4.e. Perennial and annual vegetation transects at representative locations within the recipient and control sites shall be sampled annually to capture changes in habitat.

RPM 5: *The BLM, or other jurisdictional Federal agencies as appropriate, shall ensure implementation of measures to ensure compliance with the Reasonable and*

Prudent Measures, Terms and Conditions, reporting requirements, and reinitiation requirements contained in this biological opinion.

Terms and Conditions:

5.a. The authorized desert tortoise biologist shall record each observation of desert tortoise handled. Information will include the following: location, date and time of observation, whether desert tortoise was handled, general health and whether it voided its bladder, location desert tortoise was moved from and location moved to, and unique physical characteristics of each tortoise. Reports documenting effectiveness and compliance with the desert tortoise protection measures will be prepared every six months.

The reporting requirements would include the submission of an assessment after construction of each phase is completed. Each report would outline the schedule that was followed for implementing the minimization measures as well as biological observations (as stated above) and the general success of each of the minimization measures and the maintenance activities that occurred over that period.

A final report will be submitted to the Service's Nevada Fish and Wildlife Office in Las Vegas within 90 days of completion of construction of all phases of the project.

5.b. The deaths of monitored desert tortoises shall be investigated as thoroughly as possible to determine the effectiveness of minimization measures and decide upon adaptive management measures. The Service and appropriate State wildlife agency must be informed (including data on desert tortoise identity, location, cause of death) verbally within 48 hours of a death and in writing (electronic mail is sufficient) within five business days. Fresh carcasses must be submitted for necropsy and the cost covered by the proponent. Necropsy results must be submitted to the Service and the appropriate State wildlife agencies.

5.c. Quarterly reports for monitoring and repair of tortoise-proof fencing shall be submitted to the Service's Nevada Fish and Wildlife Office in Las Vegas.

5.d. A comprehensive database of desert tortoises affected by the project shall be maintained and submitted to the Service and the appropriate State wildlife agency monthly for the first year and submitted quarterly for the duration of the project and upon request. . The BLM shall ensure that all data are collected and synthesized over the duration of the project, rather than reported only on compiled raw data. Any problems observed (e.g., rapid declines in body condition, perceived outbreaks of disease, mortality events) must be reported immediately in writing to the Service and appropriate State wildlife agency such that implementation of approved adaptive management measures occurs in a timely fashion. As a minimum, written reports must be submitted monthly for the first year and submitted quarterly for the duration of the project.

D. Closing Paragraph

The Service estimates that up to **one** desert tortoises will be accidentally injured or killed; **four** desert tortoises may be taken by harassment or captured and moved out of harm's way during project activities; and an unknown number of desert tortoises taken in the form of indirect mortality through predation by ravens or other subsidized predators drawn to the project area. The RPMs, with their implementing Terms and Conditions, are designed to minimize the effect of incidental take that might otherwise result from the proposed actions. If, during the course of the action, the level of incidental take or loss of habitat identified is exceeded, such incidental take and habitat loss represents new information requiring reinitiation of consultation and review of the RPMs provided. The BLM, or other jurisdictional Federal agencies, must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the RPMs.

E. Reporting Requirements

Upon locating a dead or injured desert tortoise within the action area, notification must be made to the Service's Nevada Fish and Wildlife Office in Las Vegas at (702) 515-5230. Care should be taken in handling sick or injured desert tortoises to ensure effective treatment and in handling of dead specimens to preserve biological material in the best possible state for later analysis of cause of death. In conjunction with the care of injured desert tortoises or preservation of biological materials from a dead animal, the finder has the responsibility to carry out instructions provided by the Service to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed. All deaths, injuries, and illnesses of desert tortoises, whether associated with project activities or not, will be summarized in an annual report.

The following actions should be taken for injured or dead desert tortoises if directed by the Service:

1. Injured desert tortoises shall be delivered to any qualified veterinarian for appropriate treatment or disposal.

2. Dead desert tortoises suitable for preparation as museum specimens shall be frozen immediately and provided to an institution holding appropriate Federal and State permits per their instructions.

3. Should no institutions want the desert tortoise specimens, or if it is determined that they are too damaged (crushed, spoiled, *etc.*) for preparation as a museum specimen, then they may be buried away from the project area or cremated, upon authorization by the Service.

4. The BLM, or other jurisdictional Federal agencies, shall bear the cost of any required treatment of injured desert tortoises, euthanasia of sick desert tortoises, or cremation of dead desert tortoises.

5. Should sick or injured desert tortoises be treated by a veterinarian and survive, they may be transferred as directed by the Service.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to use their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

- *The Service recommends the BLM protect and manage translocation recipient sites for conservation of the desert tortoise and its habitat and preclude potential further human-induced impacts in perpetuity. Managing these areas in this manner could help maintain the value of translocations as a minimization measure for these projects as well as for recovery of the desert tortoise.*

REINITIATION

This concludes formal consultation on the actions outlined in your request. As required by 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over an action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

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SECTION 7 LAND DISTURBANCE FEE PAYMENT FORM

Biological Opinion File Number: 84320-2010-F-0315

Biological Opinion Issued By: Nevada Fish and Wildlife Office, Las Vegas, Nevada

Species: Desert Tortoise (*Gopherus agassizii*) (Mojave population)

Project Name: Amargosa Farm Road Solar Energy Project

Project Proponent: Solar Millennium, LLC (Solar Trust of America)

Phone Number: ____________________

Payment Calculations:	Clark County		________ County		________ County	
	Critical habitat	Non-critical habitat	Critical habitat	Non-critical habitat	Critical habitat	Non-critical habitat
# acres anticipated to be disturbed on federal land	0	4,350				
Fee rate (per acre)	n/a	$774.00				
Total cost/habitat type (per county)	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
Total cost per county	**$ $3,366,900**		**$ -**		**$ -**	

Total payment required (all counties): $ -

Amount paid: __________ **Date:** __________ **Check/Money Order #:** __________

Authorizing agencies: Bureau of Land Management, Las Vegas Nevada

Make check payable to: Bureau of Land Management

Deliver check to:

Physical Address
Bureau of Land Management
Attn: Information Access Ctr
1340 Financial Blvd.
Reno, NV 89502

PO Box
Bureau of Land Management
Attn: Information Access Ctr
PO Box 12000
Reno, NV 89520-0006

For BLM Public Room

Process check to:
Contributed Funds-All Other
WBS: LVTFF1000800
7122 FLPMA
All other Res. Dev. Project and Management
Remarks: LLNV9300000 L71220000.JP0000 LVTFF1000800 Desert Tortoise Conservation Program

Please provide a copy of this completed payment form and the payment receipt to NV-930, Attn: T&E Program Lead
***T&E Program Lead will provide a copy to the appropriate District Office(s)*